



## **Pro et con analysis of existing ranking and occupational risk assessment concepts for nanomaterials**

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SRA-Europe 21<sup>st</sup> Annual Conference  
18–20 June 2012, ETH Zurich





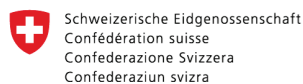
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- City and Canton of Zurich (welcome reception)
- Journal of Risk Research (apéro at the poster session)
- Law and Policy Specialty Group (apéro before the conference dinner)
- National Capital Area Chapter NCAC of the Society for Risk Analysis SRA (apéro before the conference dinner)
- Maastricht University (apéro before the conference dinner)



Swiss Confederation



## Local Organizing Committee

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# Table of contents

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Welcome to the SRA-Europe Annual Meeting 2012 in Zurich .....	3
Society for Risk Analysis (SRA) Europe .....	4
ETH Zurich .....	6
The “Consumer Behavior” professorship .....	6
Welcome to Zurich .....	7
Practical Information .....	8
 <b>Program SRA-E Zurich 18–20 June 2012 .....</b>	 <b>10</b>
Overview .....	11
Monday 18 <sup>th</sup> June .....	12
Tuesday 19 <sup>th</sup> June .....	15
Wednesday 20 <sup>th</sup> June .....	18
Plenary sessions .....	20
 <b>Keynote Abstracts .....</b>	 <b>23</b>
Monday 18 <sup>th</sup> June .....	24
Tuesday 19 <sup>th</sup> June .....	25
Wednesday 20 <sup>th</sup> June .....	26
 <b>Presentation Abstracts .....</b>	 <b>27</b>
Monday 18 <sup>th</sup> June .....	28
Tuesday 19 <sup>th</sup> June .....	60
Wednesday 20 <sup>th</sup> June .....	86
 <b>Poster Abstracts .....</b>	 <b>99</b>
Author index .....	102

# WELCOME TO THE SRA-EUROPE ANNUAL MEETING 2012 IN ZURICH

The 21<sup>st</sup> Annual Meeting of the Society for Risk Analysis Europe has been organized by the professorship Consumer Behavior, Institute for Environmental Decisions (IED) at ETH Zurich. We are proud that the 2012 meeting will take place at one of the top universities in Europe. The special theme of this conference is “Risk and Society: Decisions & Responsibilities,” to reflect the fact that the analysis of risk is inextricably linked to its social context.

This conference would not have been possible without financial support from various organizations. We thank the Federal Office for the Environment, the Federal Office of Public Health, the Federal Office for Agriculture and swissnuclear for providing financial support. Thanks to this support we were able to invite additional key-note speakers. The Monday reception is sponsored by Taylor and Francis, the publisher of the Journal of Risk Research. The reception before the conference dinner is sponsored by the Law and Policy Specialty Group, the NCAC and Maastricht University. We are grateful for the financial support of the conference.

We are also grateful to ETH Zurich for supporting the conference organization. The members of the executive committee of SRA-E helped to review the abstracts and provided valuable input for the conference organization. It was very helpful that we could use the SRA-E website for informing participants about the conference.

A special thanks goes to the members of the Consumer Behavior group for their work behind the scene. Without their effort it would not have been possible to hold this SRA-E conference in Zurich.

We hope that you will feel at home at ETH Zurich. Given the number of abstracts from different fields and various countries, we are confident that the conference will be an interesting experience for all participants.

Michael Siegrist, Simone Dohle and Carmen Keller

# SOCIETY FOR RISK ANALYSIS (SRA) EUROPE

## Student Scholarship Awards

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Zurich Conference Studentship Scholarships (each worth €500) have been awarded to:

- **Madeleine Baker-Goering**

Duke University (North Carolina)

*Risk framing, bright-lines, and relative risk: impacts on perceptions of risk from arsenic in groundwater*

Madeleine Baker-Goering, Lori Bennear, Nolan Miller

- **Rachel Southworth**

Cardiff University (Wales)

*Managing financial crime risk across global banking territories*

Rachel Southworth

- **Jesica T. Castillo-Rodriguez**

Polytechnic University of Valencia (Spain)

*Risk analysis as a tool to support emergency action planning against flood risk*

Jesica T. Castillo-Rodriguez, Ignacio Escuder-Bueno, Sara Perales-

Momparler, Armando Serrano-Lombillo, Luis Altarejos-García

### ■ WHAT IS THE SOCIETY FOR RISK ANALYSIS?

The Society for Risk Analysis (SRA), founded in 1981, represents the leading platform for interdisciplinary academic risk research. Its membership is multidisciplinary, interdisciplinary and international.

SRA provides an open forum for those who are interested in all aspects of risk analysis to share experiences, exchange ideas and to build co-operation in research and mutual support. It provides a fruitful opportunity for inter-generational and multinational exchange as well as for communication with stakeholders in industry, politics and society.

### WHY A EUROPEAN SECTION?

The Society for Risk Analysis Europe (SRA-E) was founded in 1987 as a section of SRA international to develop a special focus on risk-related issues in Europe. SRA-E aims to bring together European individuals and organizations with an academic interest in risk assessment, risk management and risk communication.

SRA-E emphasizes the European dimension in the promotion of interdisciplinary approaches of risk analysis in science. Our activities are highly relevant to practical application in industry and governance. The Charter of SRA-E, which sets out all the aims of the organization, can be found on our website at [www.sraeurope.org](http://www.sraeurope.org).

To foster strong and healthy relations between SRA-E and SRA International there is a "Memorandum of Understanding" that describes key principles of good practice and support. This can also be found on the website. There are a number of other active regional organizations in North America, Japan, Latin America, Australia, New Zealand and Russia.

## WHAT ARE THE ACTIVITIES OF SRA-E?

The SRA-E encourages and facilitates the communication among experts in all risk domains via general conferences and target focus meetings. The annual conference of SRA-E offers academics, researchers, students, policy makers, and industry representatives an opportunity to discuss 'state of the art' theory, research and policy relating to risk. We also discuss future directions and challenges in risk analysis and risk management. The annual conference takes place in various countries in Europe in order to enhance the access to SRA-E for members and risk-interested people all over Europe. We are always keen to hear from SRA-E members that are interested in hosting the conference. Additional meetings and workshops focus on specific risk topics of SRA-E interest – building links with other associations or institutions helps to communicate, collaborate and develop new methodologies for risk analysis and risk management.

In the past we have addressed issues such as natural hazard, risk communication and electro-magnetic fields, risk regulations and the precautionary principle etc. Further, SRA-E provides its members with risk related information with regard to activities and initiatives at the scientific, political and industrial level. SRA-E offers also the platform for working groups on particular risk issues which need to be developed and enhanced.

## HOW IS SRA-E ORGANIZED?

An Executive Committee comprising eight members ensures the functioning of SRA-E. For certain tasks (e.g. conference host) coopted members join the committee. A permanent secretariat is established to strengthen the liaison between members and the organization, [sraeurope@eu-vri.eu](mailto:sraeurope@eu-vri.eu).

## WHY BECOME A MEMBER? WHAT ARE THE BENEFITS?

Membership of SRA-E carries automatic membership of the international Society for Risk Analysis, founded in 1981, with over 2000 members worldwide. SRA-E has around 300 members. Being a member of SRA-E offers multiple benefits. Members are part of the scientific community and can stay in touch with the latest news in research and practice in risk analysis. Members will also receive news of events and conferences worldwide. SRA-E helps members to become familiar with national and international policies on risk analysis.

Further SRA-E encourages members to network and exchange ideas with other professionals working on different areas of risk research. The quarterly newsletter of SRA informs all members four times a year about what's going on in the Society. In addition, SRA-E regularly provides Europe-specific risk related information to its members. All members receive the journal *Risk Analysis* as part of their membership privileges and also have the opportunity to subscribe at a reduced rate to the *Journal of Risk Research*, the official journal of SRA-E and SRA-Japan. You can become a member of SRA-E through the SRA website [www.sra.org](http://www.sra.org) and by selecting the option to belong to the SRA-E regional organization.

## HOW CAN MEMBERS BECOME ACTIVE IN THE SOCIETY?

SRA-E welcomes new ideas and initiatives from members. Active members are the basis of the society and of its future. If you have views or suggestions for improving SRA-E, then please do get in touch.

You could also become involved by standing for election to the SRA-E or helping us with organizing a conference. You can contact the Executive Committee members directly or through emailing the secretariat, [sraeurope@eu-vri.eu](mailto:sraeurope@eu-vri.eu).

## SRA-E Executive Committee

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President: Margôt Kuttschreuter

President-Elect, Treasurer: Lars Bodsberg

Secretary: Julie Barnett

Councilor to SRA: Michael Siegrist

Past President: Ann Enander

Member, Nomination Committee: Sophie Gaultier-Gaillard

Co-opted member: Mathew White

SRA-Europe Secretariat

E-mail: [sraeurope@eu-vri.eu](mailto:sraeurope@eu-vri.eu)

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# ETH ZURICH

■ ETH Zurich has come to symbolize excellent education, groundbreaking basic research and applied results that are beneficial for society as a whole.

Founded in 1855, it today offers researchers an inspiring environment and students a comprehensive education as one of the leading international universities for technology and the natural sciences.

ETH Zurich has more than 17,000 students from approximately 80 countries, 3,700 of whom are doctoral candidates. More than 400 professors teach and conduct research in the areas of engineering, architecture, mathematics, natural sciences, system-oriented sciences, and management and social sciences.

ETH Zurich regularly appears at the top of international rankings as one of the best universities in the world. 21 Nobel Laureates have studied, taught or conducted research at ETH Zurich, underlining the excellent reputation of the institute.

Transferring its knowledge to the private sector and society at large is one of ETH Zurich's primary concerns. It has succeeded in this, as borne out by the 80 new patent applications each year and some 240 spin-off companies that were created out of the institute between 1996 and 2011. ETH Zurich helps to find long-term solutions to global challenges. The focal points of its research include energy supply, risk management, developing the cities of the future, global food security and human health.

# THE “CONSUMER BEHAVIOR” PROFESSORSHIP

■ Our group's aim is to enhance understanding of individual and organizational decision-making under conditions of uncertainty. We are dedicated to helping society make better decisions with regard, in particular, to the management of technological, environmental and food hazards. An intense collaboration with natural scientists is essential for achieving this goal.

We are part of the Institute for Environmental Decisions IED. The aim of the Institute for Environmental Decisions (IED) is to analyze individual and collective decisions in the context of natural resource utilization and environmental problems. Furthermore, the IED aspires to support private and political decision makers who are striving for sustainable decisions while facing a tremendous number of risks and uncertainties.

# WELCOME TO ZURICH

With a population of close to 390,000 people, Zurich is the largest city of Switzerland. It is located in the centre of Switzerland on the north shore of Lake Zurich. The city offers a broad variety of sights, museums, and galleries, many restaurants, as well as a lively nightlife. The most prominent sights and places are the Grossmünster, an old Romanesque church with a great view over Zurich, the Lake Promenade, which is a beautiful place to spend a sunny day, or the Bahnhofstrasse with its many shopping opportunities. For more information visit [www.zuerich.com](http://www.zuerich.com).



Photo: © Zurich Tourism

## How to get around

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Most attractions in Zurich, such as the lake promenade or the old town, are easily reached on foot and it is not advisable to navigate the city by car due to the lack of parking spaces and numerous one-way streets.

The city is famous for its highly well organised and clean public transport system, which comprises buses, trams, trains (S-Bahn), cable cars, and boats. The easiest way to get around is by buying a zone 10 “Stadt Zürich” ticket for the day, which gives you access to all means of transport in the zone 10 for 24 hours.

### BY TRAM AND BUS

The city has a dense network of several tram and bus lines with accurate schedules at every tram or bus stop.

### BY TRAIN (S-BAHN)

The S-Bahn is the fastest way to travel to the suburbs of Zurich with most lines passing through the main station (*Hauptbahnhof*).

### BY BOAT

There are river buses that operate in the summer between the *Landesmuseum* (near the main station) up the Limmat River and out into Lake Zurich to *Tiefenbrunnen*, with a few stops along the river.

The lake boats depart from *Bürkliplatz* (at the end of *Bahnhofstrasse*) to a variety of destinations.

# PRACTICAL INFORMATION

## How to get to the conference locations

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### CONFERENCE SITE: ETH ZURICH

The ETH Zurich main building can be reached from the main station by foot in ca. 20 minutes. If you prefer to use public transport, take the trams number 6 or 10 to the stop *ETH/Universitätsspital* (For more information visit [www.ethz.ch/about/location](http://www.ethz.ch/about/location)).

### WELCOME RECEPTION:

The welcome reception takes place at the restaurant Rigiblick on Sunday, 17<sup>th</sup> June 2012 from 6 pm to 8 pm. Attending this event will give you the opportunity to get to know the other conference participants, have a glass of wine and enjoy the beautiful view over the city and the lake of Zurich. With a bit of luck, the weather will even allow you to see a glimpse of the Alps from the restaurant's terrace.

## Wifi access

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Wifi access will be available to all participants at the congress site. The easiest way to gain access is to enable wireless connections on your computer, connect to the network called *public* and open your Internet browser. The authentication page should open automatically. Otherwise, it can be opened manually by typing the URL <http://enter.ethz.ch>. Insert Login name and Password and your network connection is ready to use.

**Login name:** srae2012, **Password:** 2012-srae

## Oral presenters

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Please bring your presentation on a USB key. Be sure to arrive at least 15 minutes before the start of your session so that everything can be uploaded and tested in time.

## Poster session

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The poster session takes place on Monday, June 18<sup>th</sup> between 5 pm and 6.30 pm. The posters are located under the arcades in front of the "Audimax" (F30 on the F floor). The accompanying apéro is kindly sponsored by the "Journal of Risk Research". You find a voucher for an alcoholic beverage and a participation card for the "Best Poster Award" in your conference documentation.

### BEST POSTER AWARD

You can select your favorite poster, write its number on the card, and drop your vote in the ballot boxes (by Monday, 6.30 pm). The votes of an expert jury and the audience will elect the best poster. The winner of the "Best Poster Award" will be announced during the SRA-E annual general assembly on Tuesday, June 19<sup>th</sup> at 5.15 pm (location: Audimax F30).

Poster presenters are encouraged to hang their posters as soon as possible and leave them hanging for the duration of the conference. The assigned spaces for the posters are flagged with the title of the poster; hangers for handouts and pins are provided at the poster session location.

## Conference dinner

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The conference dinner is held at the acqua restaurant on the left shore of lake Zurich on 19<sup>th</sup> June 2012 at 7 pm. The easiest way to get there is to take tram number 5 to the stop *Rentenanstalt* and walk along Lake Zurich, past the Seebad Enge to Mythenquai 61 (For more information visit [www.acqua.ch](http://www.acqua.ch)). The Law and Policy Specialty Group, the National Capital Area Chapter of the Society for Risk Analysis and the Maastricht University kindly sponsored the accompanying apéro.

## SRA-E annual general assembly

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On Tuesday (5.15 pm, room Audimax F30), the SRA-E annual general assembly is held. All SRA-E members are welcome. The agenda includes the status of the SRA-E 2013 conference in Norway, the student scholarship and poster awards, and the election of board members.

# PROGRAM SRA-E

## ZURICH 18–20 JUNE 2012

# Overview

TIME	ROOM	MONDAY 18 <sup>TH</sup> JUNE	TUESDAY 19 <sup>TH</sup> JUNE	WEDNESDAY 20 <sup>TH</sup> JUNE
08.00-09.00		<i>Registration and get together at the entrance hall ETH (main buliding)</i>	<i>Registration and get together at the entrance hall ETH (main buliding)</i>	<i>Registration and get together at the entrance hall ETH (main buliding)</i>
09.00-10.30	Audimax (F30)	<i>Welcome Address</i> <b>Keynote: Valerie Reyna &amp; John Adams</b>	<b>Keynote: John D. Graham &amp; Adrienne Grêt-Regamey</b>	<b>Announcement: SRA-E 2013</b> <b>Keynote: Michael Greenberg &amp; Wolfgang Kröger</b>
10.30-11.00		<i>Coffee break (foyer outside Audimax F30)</i>	<i>Coffee break (foyer outside Audimax F30)</i>	<i>Coffee break (foyer outside Audimax F30)</i>
11.00-12.30	F26.5 F26.3 F26.1 E33.1 E33.3 E33.5	<b>M1</b> Moderators of risk perception <b>M2</b> Electromagnetic fields and public health risks <b>M3</b> Symposium: Nanotechnology risks – intersections across the social sciences <b>M4</b> Symposium: PACHELBEL I: Investigating and supporting policy-making for sustainable consumption in Europe <b>M6</b> Symposium: Multicriteria methods to address risk, uncertainty, and complexity in environmental decision making <b>M5</b> New approaches in risk assessment	<b>T1</b> Symposium: Risk trade-offs <b>T2</b> Nuclear risk <b>T3</b> Food risks: Information seeking and communication  <b>T4</b> Symposium: Risk perception and risk communication in the medical context <b>T5</b> Safety in organizations	<b>W1</b> Symposium: Nuclear power after Fukushima <b>W2</b> Symposium: The making of common sense <b>W3</b> Climate change and natural hazards  <b>W4</b> Hazards in the living environment
12.30-13.30		<i>Lunch (foyer Eo-Süd)</i>	<i>Lunch (foyer Eo-Süd)</i>	<i>Lunch (foyer Eo-Süd)</i>
13.30-15.00	F26.5 F26.3 F26.1 E33.1 E33.3 E33.5	<b>M7</b> Perceiving and understanding risk <b>M8</b> Risk and the media: Investigating the EHEC outbreak <b>M9</b> Nanotechnology  <b>M10</b> Symposium: PACHELBEL II: Investigating and supporting policy-making for sustainable consumption in Europe <b>M12</b> Symposium: Eye tracking <b>M11</b> Risk assessment	<b>T6</b> Symposium: Risk governance <b>T7</b> Energy systems: the public's view <b>T8</b> Stakeholder perception of food risks: Comparing experts and lay people <b>T9</b> Symposium: Health literacy and empowerment I  <b>T10</b> Industrial risks	<b>W5</b> Risk, fear and nuclear power <b>W6</b> Precaution <b>W7</b> Governance of crime risks  <b>W8</b> Residential areas and risk
15.00-15.30		<i>Coffee break (foyer outside Audimax F30)</i>	<i>Coffee break (foyer outside Audimax F30)</i>	
15.30-17.00	F26.5 F26.3 F26.1 E33.1 E33.3 E33.5	<b>M13</b> Symposium: Associative processes in risk perception and communication: the case of food risks and benefits <b>M14</b> H1N1: risk perception and communication <b>M15</b> Symposium: Carbon capture and storage <b>M16</b> Risk governance <b>M18</b> Decision making in a complex world: how people cope with synergistic risks and ambiguities <b>M17</b> Managing natural hazards	<b>T11</b> Symposium: Coping with the risk-regulation reflex  <b>T12</b> Energy sources: risk perception and communication <b>T13</b> Food risk perception <b>T14</b> Symposium: Health literacy and empowerment II <b>T15</b> The impact of natural hazards: flood risks, tsunamis and the space weather <b>T16</b> Symposium: Future infrastructures for meeting energy demands – Helmholtz Alliance Energy-Trans	
Evening program		17.00-18.30 Poster session and apéro (foyer and gallery outside Audimax F30)	17.15 SRA-E annual general assembly (Audimax F30) 19.00 Conference dinner (restaurant acqua )	



# Monday 18<sup>th</sup> June

8.00-9.00 Registration and get together. Location: Entrance hall ETH (main buliding)  
 9.00-10.30 Welcome address. Keynotes: **VALERIE REYNA & JOHN ADAMS**. Location: Audimax (F30)  
 10.30-11.00 Coffee break (foyer outside Audimax F30)

11.00-12.30  
 Parallel  
 sessions I

M1 MODERATORS OF RISK PERCEPTION	M2 ELECTROMAGNETIC FIELDS AND PUBLIC HEALTH RISKS	M3 SYMPOSIUM: NANO-TECHNOLOGY RISKS – INTERSECTIONS ACROSS THE SOCIAL SCIENCES	M4 SYMPOSIUM: PACHEL-BEL I: INVESTIGATING AND SUPPORTING POLICY-MAKING FOR SUSTAINABLE CONSUMPTION IN EUROPE	M5 NEW APPROACHES IN RISK ASSESSMENT	M6 SYMPOSIUM: MULTICRITERIA METHODS TO ADDRESS RISK, UNCERTAINTY, AND COMPLEXITY IN ENVIRONMENTAL DECISION MAKING
Chair: Marie-Eve Cousin Room: F26.5	Chair: Liesbeth Claassen Room: F26.3	Chair: Barbara Herr Harthorn, Nick Pidgeon, Terre Satterfield Room: F26.1	Chair: Tom Horlick-Jones, Ana Prades López Room: E33.1	Chair: Steffen Foss Hansen Room: E33.5	Chair: Judit Lienert, Joseph Arvai, Ian Durbach, Timo P. Karjalainen Room: E33.3
<b>Eva Lerner, Bernhard Streicher, Rainer Sachs, Dieter Frey</b> <i>Psychological distance is dangerous, closeness is safe. How the construal level moderates the perception of individual risk and risk-taking behavior</i>	<b>Pita Spruijt, Anne Knol, René Torenvlied, Erik Lebre</b> <i>Different roles of scientific experts in advising on environmental health risks</i>	<b>Karl Bryant, Barbara Herr Harthorn</b> <i>Inequality, risk, and difference in deliberations about new technologies</i>	<b>Ana Prades López, Tom Horlick-Jones, Julie Barnett, Wilfried Konrad, Marc Poumadère, Josep Espluga-Trenc</b> <i>Understanding and supporting policy-making for sustainability: an overview of project PACHEL-BEL</i>	<b>Andrija Volkanovski</b> <i>Nuclear power plant power system reliability and nuclear safety</i>	<b>Timo P. Karjalainen, Mika Marttunen</b> <i>Multi-criteria methods as analytic-deliberative approaches: an analysis of effectiveness of advice in environmental and risk management</i>
<b>Andreea Ernst-Vintila</b> <i>Social thinking about collective risk and the three-dimensional model of personal involvement. Empirical studies in social psychology</i>	<b>Marijke Hermans</b> <i>Is wireless communication a health risk? Researching the scientific framing of a societal controversy</i>	<b>Terre Satterfield, Barbara Herr Harthorn, Anton Pitts</b> <i>Intuition, resilience and perceived environmental qualities in the case of engineered nano-materials</i>	<b>Lorenzo Marvulli, Julie Barnett, Tom Horlick-Jones, Afrodita Marcu, Ana Prades López, Josep Espluga-Trenc, Alex Boso</b> <i>Investigating the work of policy-making for sustainability</i>	<b>David Pluess, Amela Groso, Thierry Meyer</b> <i>Development of a risk analysis methodology for research &amp; teaching laboratories</i>	<b>Ian Durbach</b> <i>Tools for representing uncertainty in decision aid: evidence from simulation and behavioural experiments</i>
<b>Johannes Brinkmann, Magne Aarset</b> <i>Risk and responsibility – presenting a pilot study</i>	<b>Diana van Dongen, Liesbeth Claassen, Tjabe Smid, Daniëlle Timmermans</b> <i>The relationships between trust in government policy, perceived control, and people's responses to public and personal sources of electromagnetic fields</i>	<b>Adam Corner, Karen Parkhill, Nick Pidgeon, Naomi Vaughan</b> <i>Moving upstream from nano to geo – public perceptions and geoengineering proposals</i>	<b>Wilfried Konrad, Marc Poumadère, Tom Horlick-Jones, Ana Prades López</b> <i>Engaging with, and investigating, lay sustainability-related practices</i>	<b>Alessio Ishizaka, Ashraf Labib</b> <i>A combined AHP-crisis tree analysis-mathematical programming approach to evaluate and prevent disasters</i>	<b>Judit Lienert</b> <i>Making hard decisions to ensure safe water supply and wastewater disposal in uncertain futures</i>
<b>Marie-Eve Cousin, Angela Bearth, Michael Siegrist</b> <i>What is the real influence of knowledge on risk perception?</i>	<b>Liesbeth Claassen, Ann Bostrom, Daniëlle Timmermans</b> <i>Assessing focal points for adjusting information about exposure to electromagnetic fields and health risks: a mental models approach</i>	<b>Ann Bostrom</b> <i>Learning from labels on nano-technology products</i>	<b>Tom Horlick-Jones, Ana Prades López, Jonathan Rosenhead, Wilfried Konrad, Marc Poumadère</b> <i>Translating between social worlds of policy and everyday life: the STAVE tool</i>	<b>Steffen Foss Hansen, Keld Alstrup-Jensen, Anders Baun</b> <i>Pro et con analysis of existing ranking and occupational risk assessment concepts for nano-materials</i>	<b>Joseph Arvai</b> <i>Coming out from behind the computer: multicriteria approaches for more meaningfully engaging local stakeholders in consequential risk management decisions</i>

12.30-13.30 Lunch break (foyer Eo-Süd)

13.30-15.00  
Parallel  
sessions II

#### M7 PERCEIVING AND UNDERSTANDING RISK

Chair: Margôt Kuttschreuter  
Room: F26.5

**Dagmar Wiebusch, Jack Rowley, Chris Althaus, Michael Milligan**

*International survey of knowledge of mobile phone specific absorption rate (SAR) information among mobile phone users*

**Jarry Porsius, Liesbeth Claassen, Fred Woudenberg, Tjabe Smid, Daniëlle Timmermans**  
*Psychosocial effects of new power lines: design of a longitudinal field study*

**Marcia Grisotti, Fernando Dias de Avila Pires**  
*The concept of emerging infectious diseases revisited: new challenges for understanding and communication of risks*

**Margôt Kuttschreuter**  
*Lyme disease: risk perception and information seeking*

#### M8 RISK AND THE MEDIA: INVESTIGATING THE EHEC OUTBREAK

Chair: Julie Barnett  
Room: F26.3

**Melanie De Vocht, Verolien Cauberghe, Benedikt Sas, Mieke Uyttendaele**

*The impact of the news coverage of the EHEC-outbreak on risk perceptions using the extended parallel processing model*

**Gema Revuelta, Gloria Cugat, Veronica Escurriol, Patricia Gosalbez**  
*Communication of a food alert. The case of the so-called "killer cucumbers"*

**Julie Barnett, Timothy Cribbin, Aine Regan, Rui Gaspar**  
*Social media and communication of risk: the case of EHEC/E-coli*

#### M9 NANOTECHNOLOGY

Chair: Sharon Friedman  
Room: F26.1

**Amber Ronteltap, Rob van Veggel, Jantine Voordouw, Daniëlla Stijnen, Arnout Fischer**  
*Consumer perceptions of nanotechnological applications in food and agriculture*

**Zhen Ge, Guodong Sun**  
*Understanding public risk perception of nanotechnology*

**Anja Dijkman, Anne Dijkstra, Cees van Woerkum, Jeroen Terwoert**  
*How to regulate and communicate nanomaterials' health risks in the face of uncertainty?*

**Sharon Friedman, Brenda Egolf**  
*Debating nanotechnology regulation and risks in the U.S. and U.K. media*

#### M10 SYMPOSIUM: PACHEL-BEL II: INVESTIGATING AND SUPPORTING POLICY-MAKING FOR SUSTAINABLE CONSUMPTION IN EUROPE

Chair: Tom Horlick-Jones, Ana Prades López  
Room: E33.1

**Marc Poumadère, Raquel Bohn Bertoldo, Alex Boso, Josep Espluga-Trenc, Christian Oltra, Claire Mays, Ana Prades López, Nina Schneider**  
*Is being smart enough? The case of electricity 'smart meters' in France and Spain*

**Josep Espluga-Trenc, Julie Barnett, Ann Enander, Susanne Hede, Tom Horlick-Jones, Wilfried Konrad, Afrodita Marcu, Lorenzo Marvulli**  
*Filling the gap between discourse and action: the case of domestic consumption practices*

**Marian Constantin, Afrodita Marcu**  
*Citizens' understanding of energy consumption in Romania: the case of domestic insulation*

**Ann Enander, Susanne Hede**  
*Issues and dilemmas of sustainable mobility from a citizen perspective*

#### M11 RISK ASSESSMENT

Chair: Dario Gregori  
Room: E33.5

**Cian O'Mahony**  
*High performance computing and dietary risk assessment software*

**François Allard**  
*The difficult path to sustainable use of pesticides: risk assessment, rationality and contexts in European Commission's procedures*

**Dario Gregori, Paola Berchialla, Daniele Chiffi, Arber Haxhiaj**  
*Comparing Bayesian network, artificial neural networks, classification trees and classical logistic models in quantitative risk assessment: an application to the European Registry of Foreign Body Injuries in Children*

#### M12 SYMPOSIUM: EYE TRACKING

Chair: Rebecca Hess, Vivianne H. M. Visschers  
Room: E33.3

**Rebecca Hess, Michael Siegrist**  
*Nutrition communication on food packages – does format matter?*

**Jacob L. Orquin, Simone Mueller Loose**  
*Visual attention as a process trace for decision making*

**Michael Schulte-Mecklenbeck, Ryan O. Murphy**  
*Flashlight (online attention tracking) and risky decision making*

**Carmen Keller, Rebecca Hess, Michael Siegrist**  
*Eye tracking as method to examine intuitive and deliberative decision making in low and high numerates*

15.00-15.30 Coffee break (foyer outside Audimax F30)

15.30-17.00  
Parallel  
sessions III

M13 SYMPOSIUM: ASSOCIATIVE PROCESSES IN RISK PERCEPTION AND COMMUNICATION: THE CASE OF FOOD RISKS AND BENEFITS	M14 H1N1: RISK PERCEPTION AND COMMUNICATION	M15 SYMPOSIUM: CARBON CAPTURE AND STORAGE	M16 RISK GOVERNANCE	M17 MANAGING NATURAL HAZARDS	M18 DECISION MAKING IN A COMPLEX WORLD: HOW PEOPLE COPE WITH SYNERGISTIC RISKS AND AMBIGUITIES
Chair: Afrodita Marcu, Julie Barnett Room: F26.5	Chair: Britt-Marie Drottz-Sjöberg Room: F26.3	Chair: Selma L'Orange Seigo Room: F26.1	Chair: Ibo van de Poel Room: E33.1	Chair: Elisabeth Krausmann Room: E33.5	Chair: Ian Dawson Room: E33.3
<b>Rui Gaspar, João Carvalho, Beate Seibt, Luisa Lima</b> <i>The role of uncertainty and food category salience on the risk perception contamination of food products</i>	<b>Cindy Jardine, Leah Lechelt, Tania Bubela</b> <i>H1N1 risk communication for pregnant women and seniors</i>	<b>Diana Schumann</b> <i>Risk perceptions and communication of CO<sub>2</sub> Capture and Storage (CCS)</i>	<b>Karin Ammerlaan, Marjolein van Asselt</b> <i>Balancing act. On the sharing of responsibility for physical safety</i>	<b>Kalliopi Sapountzaki</b> <i>Risk-responsible institutions as agents, conveyors and recipients of vulnerability</i>	<b>Jonathan Gheysens</b> <i>Are conditional contribution profiles determined by context and framing: the case of rural villagers in Benin</i>
<b>Aine Regan, Patrick Wall</b> <i>Investigating European consumers' reactions to the communication of food risk uncertainty</i>	<b>S. Michelle Driedger, Margaret Fast</b> <i>Canadian local public health unit responses to pandemic H1N1: risk communication challenges</i>	<b>Selma L'Orange Seigo, Joseph Arvai, Simone Dohle, Michael Siegrist</b> <i>Public perception of CCS in Switzerland and Canada: a comparison</i>	<b>Kati Orru</b> <i>Risk regulation in Europeanising Eastern Europe: cases of Estonia and Lithuania</i>	<b>Jesica T. Castillo-Rodríguez, Ignacio Escuder-Bueno, Sara Perales-Momparler, Armando Serrano-Lombillo, Luis Altarejos-García</b> <i>Risk analysis as a tool to support emergency action planning against flood risk</i>	<b>Ozlem Ozdemir Yilmaz, Cengiz Yilmaz</b> <i>Investigating risk reduction mechanisms in outcome ambiguity: experimental evidence</i>
<b>Afrodita Marcu, Julie Barnett</b> <i>The impact of episodic and thematic framing on food risk associations under conditions of uncertainty</i>	<b>Franziska Boerner, Laura Winton, Jennifer Keelan, S. Michelle Driedger, Cindy Jardine</b> <i>"It is just like flu" – H1N1 vaccination uptake and the curse of habitual risk perception and behavior pattern</i>	<b>Lasse Wallquist, Matthias Holenstein</b> <i>A comparison of mental risk concepts on carbon dioxide capture and storage (CCS) and deep geothermal energy (DGE)</i>	<b>Marie-Valentine Florin, Len Fisher</b> <i>Risk governance of slow-developing catastrophic risks</i>	<b>Kristine Størkersen</b> <i>Cargo – dead or alive. Comparison of risk-based decision-making in operations at different vessels in the Norwegian aquaculture industry</i>	<b>Richard Eiser</b> <i>Synergy is real</i>
<b>Pieter Rutsaert, Wim Verbeke</b> <i>Can previously made associations prevent social amplification in risk messages?</i>	<b>Britt-Marie Drottz-Sjöberg, Yves Charpak</b> <i>H1N1, science and society</i>		<b>Ibo van de Poel</b> <i>New technologies as social experiments</i>	<b>Elisabeth Krausmann, Georgios Giannopoulos</b> <i>The impact of space weather on critical infrastructures – how real is the risk?</i>	<b>Ian Dawson, Johnnie Johnson, Michelle Luke</b> <i>Human judgements of synergistic risks: perspectives from evolutionary psychology and potential directions for risk communication</i>

17.00-18.30 POSTER SESSION AND APÉRO, foyer and gallery outside Audimax (F30)

# Tuesday 19<sup>th</sup> June

8.00-9.00 Registration and get together. Location: Entrance hall ETH (main buliding)  
 9.00-10.30 Keynotes: **JOHN D. GRAHAM & ADRIENNE GRÊT-REGAMEY**. Location: Audimax (F30)  
 10.30-11.00 Coffee break (foyer outside Audimax F30)

11.00-12.30  
 Parallel  
 sessions I

T1 SYMPOSIUM: RISK TRADE-OFFS	T2 NUCLEAR RISK	T3 FOOD RISKS: INFORMATION SEEKING AND COMMUNICATION	T4 SYMPOSIUM: RISK PERCEPTION AND RISK COMMUNICATION IN THE MEDICAL CONTEXT	T5 SAFETY IN ORGANIZATIONS
Chair: Michael Stauffacher Room: F26.5 <b>Roland W. Scholz</b> <i>Transdisciplinarity and environmental risks</i>  <b>Bruno Merz</b> <i>Flood risk management and risk-based decision making</i>	Chair: Roman Seidl Room: F26.3 <b>Guizhen He, Lei Zhang, Arthur P. J. Mol, Yonglong Lu</b> <i>Communicating nuclear risk in a distrusted environment in China</i>  <b>Behnam Taebi</b> <i>The ethical acceptability of multinational nuclear waste repositories</i>	Chair: Astrid Epp Room: F26.1 <b>Femke Hilverda, Margôt Kuttschreuter</b> <i>Determinants of information seeking about food risks</i>  <b>Jordi Prades, Jordi Farré</b> <i>Journalists and digital citizen contributors relationships. New identities and roles to be played in food risks/benefits communication</i>	Chair: Carmen Keller Room: E33.1 <b>Niels Haase, Frank Renkewitz, Cornelia Betsch</b> <i>Measuring subjective probability in the context of vaccination risks</i>  <b>Roland H. Grabner, Carmen Keller, Karl Koschutnig, Franz Ebner, Gernot Reishofer, Simone Dohle, Michael Siegrist</b> <i>Neurocognitive mechanisms underlying effects of numeracy and mathematical competence on health risk perception</i>  <b>Harald Schupp, Ralf Schmälzle, Britta Renner</b> <i>Risk perception and neuroscience: new perspectives on health psychology</i>	Chair: Ragnar Rosness Room: E33.3 <b>Tor Olav Grøtan</b> <i>Operational risk due to emergence and systemic effects in ICT-mediated collaboration</i>  <b>Marcus Borjesson, Ann Enander</b> <i>Relationships between leadership and employees' risk and safety perceptions, attitudes and behaviours within civil and military contexts</i>
<b>Niels Holthausen, Pamela Köllner-Heck, Michael Bründl, Sabine Perch-Nielsen, Marco Pütz, Peter Locher, Thomas Probst, Roland Hohmann</b> <i>Climate change risk analysis for transparent adaptation decision making</i>	<b>Corinne Moser, Michael Stauffacher, Yann B. Blumer, Roland W. Scholz</b> <i>Beyond risk perception: The role of perceived adaptive capacity for the acceptance of contested infrastructure</i>  <b>Roman Seidl</b> <i>Public values and the siting of contested infrastructure. Considerations concerning a prospective Swiss radioactive waste repository</i>	<b>Giulia Mascarello, Stefania Crovato, Barbara Tiozzo, Corrado Petrucco, Michael Siegrist, Licia Ravarotto</b> <i>Chemical risk in food: comparing web- and paper-based communication tools</i>  <b>Astrid Epp</b> <i>Pesticide residues in German media – analysis of media coverage</i>	<b>Irene Wærø, Ragnar Rosness</b> <i>Building safety in fragmented organizations</i>  <b>Ragnar Rosness, Ranveig K. Tinnmannsvik, Irene Wærø</b> <i>Environmental conditions for safety and the responsibilities of senior management</i>	

12.30-13.30	Lunch break (foyer Eo-Süd)				
13.30-15.00 Parallel sessions II	<b>T6 SYMPOSIUM: RISK GOVERNANCE</b>	<b>T7 ENERGY SYSTEMS: THE PUBLIC'S VIEW</b>	<b>T8 STAKEHOLDER PERCEPTION OF FOOD RISKS: COMPARING EXPERTS AND LAY PEOPLE</b>	<b>T9 SYMPOSIUM: HEALTH LITERACY AND EMPOWERMENT I</b>	<b>T10 INDUSTRIAL RISKS</b>
	Chair: Peter Greminger Room: F26.5 <b>Ortwin Renn</b> <i>Inclusive governance: public participation in risk decision making</i>	Chair: Olivier Salvi Room: F26.3 <b>Yves Pepermans, Ilse Loots, Pieter Maesele</b> <i>Beyond the backyard. Wind farm wars from a risk conflict perspective</i>	Chair: Alexandra Zingg Room: F26.1 <b>Marleen Kraaij-Dirkzwager, Erik Lebre</b> <i>Stakeholder concerns and risk perception about intensive animal production systems influencing the debate about public health decision making in the Netherlands</i>	Chair: Ana Maria Moreno Londono Room: E33.1 <b>Nicola Diviani</b> <i>What should we know about cancer? Establishing a concept of cancer literacy</i>	Chair: Lars Bodsberg Room: E33.3 <b>Salman Nazir, Simone Colombo, Davide Manca</b> <i>Use of virtual reality for anticipation and reduction of risks in process industry</i>
	<b>Ragnar Löfstedt</b> <i>Better regulation in Europe: next steps</i>	<b>Karen Parkhill, Catherine Butler, Nick Pidgeon</b> <i>Contested energy risks in context: using a whole system lens to explore low carbon transitions with the public</i>	<b>Natalia Lozano, Monica Lores, Jordi Farré</b> <i>Social media in food safety communication: experts and consumers perceptions</i>	<b>Maddalena Fiordelli, Sarah Mantwill, Peter J. Schulz</b> <i>EMPOWER: support of patient empowerment by an intelligent self-management pathway for patients suffering from diabetes</i>	<b>Monika Filipsson, Stina Alriksson</b> <i>Environmental decision-making within the steel industry: the role of individuals' worries, knowledge and responsibility</i>
	<b>Raffaele Chiacchia</b> <i>Risk management of the Swiss Confederation</i>	<b>Matthias Holenstein, Lasse Wallquist</b> <i>Success factors for participatory procedures in deep geothermal energy projects</i>  <b>Olivier Salvi, Sébastien Evanno</b> <i>Risk management in the development of new energy technologies</i>	<b>Alexandra Zingg, Michael Siegrist</b> <i>Gender differences in lay people and experts concerning their decisions about different strategies to fight epidemics</i>	<b>Anne-Linda Frisch, Peter J. Schulz</b> <i>Predictors, mediators and moderators of psychological empowerment: results from a cross-sectional study with chronic low back pain patients in Switzerland</i>	<b>Jean-François David</b> <i>From legal liability and environmental forensics to efficient enforcement when multiple sources of pollution: an example with urban planning and brownfield restoration</i> <b>Lars Bodsberg, Stein Hauge, Solfrid Håbrekke, Tony Kråkenes</b> <i>Environmental risk acceptance criteria applied in the Norwegian petroleum industry</i>

15.00-15.30 Coffee break (foyer outside Audimax F30)

15.30-17.00  
Parallel  
sessions III

T11 SYMPOSIUM: COPING WITH THE RISK-REGULATION REFLEX	T12 ENERGY SOURCES: RISK PERCEPTION AND COMMUNICATION	T13 FOOD RISK PERCEPTION	T14 SYMPOSIUM: HEALTH LITERACY AND EMPOWERMENT II	T15 THE IMPACT OF NATURAL HAZARDS: FLOOD RISKS AND TSUNAMIS	T16 SYMPOSIUM: FUTURE INFRASTRUCTURES FOR MEETING ENERGY DEMANDS – HELMHOLTZ ALLIANCE ENERGY-TRANS
Chair: Frederic Boudier Room: F26.5 <b>Ira Helsloot</b> <i>Mechanisms causing the risk-regulation reflex</i>	Chair: Christina Demski Room: F26.3 <b>Motoko Kosugi</b> <i>Why do information providers try to conceal risky information?</i>	Chair: Marijn Poortvliet Room: F26.1 <b>Licia Ravarotto, Stefania Crovato, Giulia Mascarello, Laura Contalbrigo, Barbara Tiozzo</b> <i>Self-perception of food related risks: a survey of Italian consumers</i>	Chair: Anne-Linda Frisch Room: E33.1 <b>Ana Maria Moreno Londono, Peter J. Schulz</b> <i>Do patient's judgment skills matter in the health literacy ambit?</i>	Chair: Florent Pratlong Room: E33.3 <b>Funda Atun</b> <i>The case of London: dealing with complex urban systems and evacuation of public in case of flooding</i>	Chair: Pia-Johanna Schweizer Room: E33.5 <b>Witold-Roger Poganietz</b> <i>Technical-societal development</i>
<b>Jan van Tol</b> <i>The risk and responsibility programme in the Netherlands</i>	<b>Midori Aoyagi</b> <i>Risk perception of climate change and choice of energy source January 2007 and after the Fukushima accident in March 2011</i>	<b>Henrik Merckelsen, Gorm Gabrielsen</b> <i>Between fragmentation and segmentation: a relational model of consumers' food risk perceptions</i>	<b>Arthur Dubowicz</b> <i>Sleepless risks. Decisions of insomnia patients</i>	<b>Herman Van der Most, Teun Terpstra, Jan Gutteling</b> <i>Understanding flood risk perception in the Netherlands and its implications for self-protective action</i>	<b>Gerhard Fuchs, Nele Hinderer, Mario Neukirch</b> <i>Innovation and insecurity: transforming the energy system in Germany</i>
<b>Henry Rothstein</b> <i>Risk and other 'psychopathologies' of governance: Exploring national varieties of risk governance in Europe</i>	<b>Roh Pin Lee</b> <i>Education, gender and perception of dominant energy sources</i>	<b>Machiel Reinders, Amber Ronteltap</b> <i>Risk and utility perceptions of new food technology – the added value of implicit measurement</i>	<b>Melanie Connor, Sarah Mantwill, Peter J. Schulz</b> <i>Functional health literacy in Switzerland – validation of a German, Italian, and French health literacy test</i>	<b>Florent Pratlong, Sophie Gaultier-Gaillard</b> <i>How do we perceive tsunamis in French islands? The case of The Reunion Island</i>	<b>Carsten Orwat</b> <i>Systemic risks in the electric power infrastructure?</i>
<b>Michel van Eeten, Frederic Boudier</b> <i>The diva and fate. Can the voter be pleased with fatalism?</i>	<b>Christina Demski, Nick Pidgeon, Wouter Poortinga</b> <i>Public perceptions of energy security risks</i>	<b>Marijn Poortvliet, Marijn De Bruin, Bob Mulder</b> <i>Predicting intentions to use novel biotechnologies: the role of risk perception, trust, knowledge, and social norms</i>			<b>Birgit Mack</b> <i>User behavior</i>

17.15 **SRA-E ANNUAL GENERAL ASSEMBLY.** Location: Audimax (F30)

19.00 **CONFERENCE DINNER.** Location: Restaurant acqua



## Wednesday 20<sup>th</sup> June

8.00-9.00 Registration and get together. Location: Entrance hall ETH (main building)

9.00-10.30 **ANNOUNCEMENT SRA-E 2013**, Keynotes: **MICHAEL GREENBERG & WOLFGANG KRÖGER**. Location: Audimax (F30)

10.30-11.00 Coffee break (Foyer outside Audimax F30)

11.00-12.30 Parallel sessions I	W1 SYMPOSIUM: NUCLEAR POWER AFTER FUKUSHIMA	W2 SYMPOSIUM: THE MAKING OF COMMON SENSE	W3 CLIMATE CHANGE AND NATU- RAL HAZARDS	W4 HAZARDS IN THE LIVING EN- VIRONMENT
	<p>Chair: Vivianne H. M. Visschers Room: F26.5</p> <p><b>Verena Klusmann, Katja Neumann, Britta Renner</b> <i>Now you see the panic, now you don't: general and personal risk perceptions in German laypersons before and after the Fukushima nuclear accident</i></p> <p><b>Michael Rudolf</b> <i>Public preference changes of electricity options following Fukushima</i></p> <p><b>Vivianne H. M. Visschers, Michael Siegrist</b> <i>Results of a longitudinal survey on the Swiss public's perception of nuclear power before and after Fukushima</i></p> <p><b>Nick Pidgeon</b> <i>Nuclear Power in Britain after Fukushima: a case of risk attenuation?</i></p>	<p>Chair: Helene Joffe Room: F26.3:</p> <p><b>Helene Joffe, Tiziana Rossetto</b> <i>Social representations of earthquakes: a study of people living in three high seismic areas</i></p> <p><b>Nicholas Smith, Helene Joffe</b> <i>How the public engages with global warming: a social representations approach</i></p> <p><b>Peter Washer</b> <i>Making (common) sense of the risk of new infectious diseases</i></p> <p><b>Clíodhna O'Connor</b> <i>Risk and the brain: how the media represents risks to brain health</i></p>	<p>Chair: Gisela Böhm Room: F26.1</p> <p><b>Seda Kundak, Handan Turkoglu, Alper Ilki</b> <i>Social capital in risk perception</i></p> <p><b>Matthew White, Sara Hayes</b> <i>Integrating hazard and social vulnerability analysis for volcanic activity at Mount Rainier</i></p> <p><b>Merryn Thomas, Nick Pidgeon, Lorraine Whitmarsh, Rhoda Ballinger</b> <i>Sea-level change on the Severn Estuary: creating an expert model of the risks</i></p> <p><b>Gisela Böhm, Ann Bostrom, Robert O'Connor, Daniel Hanss</b> <i>A cross-national comparison of causal beliefs, risk perceptions, and policy preferences with respect to climate change</i></p>	<p>Chair: Ric van Poll Room: E33.1</p> <p><b>David Ormandy, Véronique Ezratty</b> <i>Effectiveness of campaigns on raising awareness of the risk from carbon monoxide in a student population</i></p> <p><b>Véronique Ezratty, David Ormandy, Serge Koscielny</b> <i>Communicating risks from CO: a pilot study among tenants of UK public housing</i></p> <p><b>Madeleine Baker-Goering, Lori Ben-near, Nolan Miller</b> <i>Risk framing, bright-lines, and relative risk: impacts on perceptions of risk from arsenic in groundwater</i></p> <p><b>Ric van Poll, Oscar Breugelmans, Jeroen Devilee</b> <i>Concern about the residential situation in the Netherlands</i></p>

12.30-13.30	Lunch break (Foyer Eo-Süd)			
13.30-15.00	<b>W5 RISK, FEAR AND NUCLEAR POWER</b>	<b>W6 PRECAUTION</b>	<b>W7 GOVERNANCE OF CRIME RISKS</b>	<b>W8 RESIDENTIAL AREAS AND RISK</b>
Parallel sessions II	<p>Chair: Matthias Dhum Room: F26.5</p> <p><b>Shoji Ohtomo, Yukio Hirose</b> <i>Determinants of avoidant purchasing behaviors due to fear of radioactive pollution</i></p> <p><b>Jean-Louis Tavani, Andreea Ernst-Vintila</b> <i>Risks as objects of collective fear. A case study in social psychology after Japan 2011</i></p> <p><b>Matthias Dhum, Corinne Moser, Pius Kruetli, Michael Stauffacher, Roland W. Scholz</b> <i>The role of emotional images in the differential perception of nuclear technologies</i></p>	<p>Chair: Sweta Chakraborty Room: F26.3</p> <p><b>Eve Feinblatt</b> <i>The influence of precaution on the treatment of uncertainties in food risk assessment</i></p> <p><b>Juan Martinez-Torvisco, Ernesto Suarez, Luisa Lima, Rui Gaspar, Sara Gorjão</b> <i>Confirmatory factor analysis of a scale of social beliefs about the environmental precaution and its relationship with the new paradigm of human interdependence and risk perception</i></p> <p><b>Oliver Todt, José Luis Luján</b> <i>The varieties of precaution</i></p> <p><b>Sweta Chakraborty, Ragnar Löfstedt</b> <i>Regulatory transparency: two qualitative studies of US FDA initiatives and their implications for Europe</i></p>	<p>Chair: Tim Prior Room: F26.1</p> <p><b>Jerry Busby, Dan Prince</b> <i>Risk complicity perception: the case of web-enabled telephony</i></p> <p><b>Rachel Southworth</b> <i>Managing financial crime risk across global banking territories</i></p> <p><b>Tim Prior</b> <i>Risk and resilience in security governance</i></p>	<p>Chair: Sophie Gaultier-Gaillard Room: E33.1</p> <p><b>Jeroen Devilee, Irene Van Kamp</b> <i>Crossover effects between noise annoyance and environmental risk perceptions. The intermediating role of the meaning of sounds</i></p> <p><b>Sophie Gaultier-Gaillard, Florent Pratlong</b> <i>Is it worth creating green corridors in cities?</i></p>

## Plenary sessions

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**John Adams** is an Emeritus Professor of Geography at University College London. He was a member of the original Board

of Directors of Friends of the Earth in the early 1970s and has been involved in debates about environmental issues ever since. He is intrigued by the persistence of attitudes to risks. For the past 30 years, the same arguments, slogans and insults have been shouted past each other by the participants (or their descendants) in disputes about issues for which conclusive evidence is lacking. His current work on both risk and transport issues seeks to understand these attitudes and the reasons for their persistence, in the hope of transforming shouting matches into more constructive dialogues.

His website [www.john-adams.co.uk](http://www.john-adams.co.uk) encapsulates his present research interests. His attraction to transport risks and threats to the environment grew out of his involvement in the 1970s and 80s as a participant in public inquiries into the UK Government's road building plans.

In the last few years his interest in risk has broadened to include its financial aspects. John Adams is an Honorary Member of the Institute of Risk Management.



**John D. Graham** is Dean of Indiana University's School of Public and Environmental Affairs, one of the largest professional schools of public affairs in the world. Prior to joining IU, Dr. Graham served as Dean of the Pardee RAND Graduate School (2006–2008), as a Senate-confirmed administrator in the White House Office of Management and Budget (2001–2006) in the George W. Bush administration, and as a professor at the Harvard School of Public Health (1985–2001). He was elected President of the Society for Risk Analysis (SRA) in 1995 and earned SRA's Distinguished Lifetime Achievement Award in 2009. He is the author of eight books and more than 100 peer-reviewed scientific articles. He earned his BA, MA and Ph.D. degrees at Wake Forest University, Duke University and Carnegie-Mellon University, respectively.



**Michael Greenberg** studies risk analysis and environmental health. He is professor and dean of the faculty of the

Edward J. Bloustein School of Planning and Public Policy, and directs several research centers about risk-related issues. His books include *Urbanization and Cancer Mortality* (1983), *Environmentally Devastated Neighborhoods in the United States* (1996), *Environmental Policy Analysis & Practice* (2008), and *Reporter's Handbook on Nuclear Materials, Energy, and Waste Management* (2009). His most recent book is *The Environmental Impact Statement After Two Generations: Managing Environmental Power*, New York: Routledge (2011). He just signed a contract with Springer publishers to write *Nuclear Waste Management, Nuclear Power and Energy Choices: Public Preferences, Perceptions, and Trust*. In addition to 28 books, professor Greenberg has contributed more than 325 articles to social science and policy journals. He has been a member of National Research Council Committees that focus on the destruction of the U.S. chemical weapons stockpile and nuclear weapons; chemical waste management; and the degradation of the U.S.

government physical infrastructure. He has received awards for research from the United States Environmental Protection Agency, the Society for Professional Journalists, the Public Health Association, the Association of American Geographers, and Society for Risk Analysis. He serves as associate editor for environmental health for the *American Journal of Public Health*, and is editor-in-chief of *Risk Analysis: An International Journal*.



**Adrienne Grêt-Regamey** has been Associate Professor at the Chair of Planning Landscape and Urban Systems (PLUS) of Landscape and Environmental Planning at the Institute for Spatial and Landscape Planning in the Department of Civil, Environmental and Geomatics Engineering, since 2008. Her research focuses on integrating the goals of sustainable development, economic viability, and good governance in spatial planning.

1998 she graduated with a Diploma in environmental sciences from ETH Zurich. 1995–1999 she continued at ETH Zurich as a diploma student in education with emphasis on biology and environmental sciences.

From 1999–2002 Adrienne Grêt-Regamey was an associate at Stratus Consulting, Boulder, CO, USA. 2002–2004 she worked as Project Scientist, Environmental and Societal Impact Group, NCAR, Boulder. From 2004–2007 she was a doctoral student in spatial planning at the Institute for Spatial and Landscape Planning at ETH Zurich, and the Environmental and Societal Impact Group, NCAR, Boulder.

2007–2008 she returned as a research fellow to ETH Zurich's Institute for Spatial and Landscape Planning. 2007–2008 Adrienne Grêt-Regamey worked as a scientific officer at the Swiss Federal Office for the Environment (FOEN) in Bern.



**Wolfgang Kröger** has been Ordinarius of Safety Technology at the ETH Zurich since 1990 and director of the Laboratory for Safety Analysis. Before being elected IRGC's Founding Rector in 2003 he headed research in nuclear energy and safety at the Paul Scherrer Institut (PSI), where he was also on the board of directors. After his retirement at the beginning of 2011 he has become the executive director of the newly established ETH Risk Center.

He has been strongly involved in the risk and vulnerability analysis of complex technical systems and in putting the assessment and management of technological risks into a broader context. He is 'inter alia' individual member of the Swiss Academy of Sciences and chairs its topical platform "Risks" and is Distinguished Affiliated Professor of TU Munich.



**Valerie Reyna** is professor of human development and psychology at Cornell University and a co-director of the Center for Behavioral Economics and Decision Research and of the Cornell University Magnetic Resonance Imaging Facility. She is also past president of the Society for Judgment and Decision Making. Dr. Reyna's research encompasses human judgment and decision making, numeracy and quantitative reasoning, risk and uncertainty, medical decision-making, social judgment, and false memory. She is a developer of fuzzy-trace theory, a model widely applied in law, medicine, and public health. Her recent work has focused on aging, neurocognitive impairment, and genetic risk factors; rationality and risky decision-making, particularly risk taking in adolescence; and neuroimaging models of framing and decision-making.

She also has extended fuzzy-trace theory to risk perception, numeracy, and dual processes in medical decision-making by both physicians and patients. In addition, Dr. Reyna teaches an undergraduate and a graduate seminar on risk and rational decision-making.



# KEYNOTE ABSTRACTS



# MONDAY 18<sup>TH</sup> JUNE

## **Risky decision making: a fuzzy-trace framework for understanding the brain**

*Valerie Reyna (Cornell University)*

■ Building on results from experiments, survey research, and mathematical models, fuzzy-trace theory places gist-based intuition at the heart of risky decision making in advanced reasoners. Using both behavioral and neuroimaging data, I describe the implications of this intuitionist framework for understanding the brain. In particular, I present the first neuroimaging results that disconfirm standard risk-reward valuation approaches, but which are predicted by fuzzy-trace theory. These critical results illuminate reversals in risk attitudes under gain vs. loss framing, as well as developmental reversals in which more advanced reasoners display greater judgment-and-decision-making biases. Real-world examples of gist-based intuition will be presented to illustrate these predictive principles.

## **What is risk?**

*John Adams (University College London)*

■ I propose to expand on a recent posting on my website – "ISO 31000: Dr Rorschach meets Humpty Dumpty – <http://www.john-adams.co.uk/2012/02/22/iso-31000/>".

One of the first things that the Society for Risk Analysis did when it came into existence was to form a committee to define "risk". After four years it gave up, declaring in its final report that it was perhaps best not to try to define it, but to allow anyone using the word to define it in his or her own way.

Now, in "ISO 31000: Risk Management – Principles and Guidelines", the ISO has defined risk in its own way: "Risk is the effect of uncertainty on objectives – positive and/or negative." It is impressively determined that everyone using its guide should know exactly what the word means and how it should be used. ISO 31000 provides copious notes, terms and definitions elaborating on the meaning and use of the word, plus a separate 15-page dictionary.

For a document that aspires to become an International Standard for risk managers it has two main problems. Its insistence that risk can be positive is supported by no standard dictionaries which all define it as a possibility/probability of something negative happening. Second it can be found in no libraries and it costs £140. This lack of library access plus the daunting paywall will severely limit the proportion of the world's population ever likely to read it – including, perhaps of particular relevance to this conference, numerous academics with an interest in risk.

# TUESDAY 19<sup>TH</sup> JUNE

## **The push for the electric car: risk management or industrial policy?**

*Bradley W. Lane, Natalie Messer, Devin Hartman, Sanya Carley, John D. Graham (School of Public & Environmental Affairs at Indiana University)*

■ Political jurisdictions around the world are enacting new policies to promote the production, purchase and use of plug-in electric vehicles. Are these policies designed to reduce risks (e.g., risks of urban smog, climate change and energy security) or are they designed to establish a new source of sustainable jobs and prosperity for the sponsoring political jurisdiction? To what extent are the goals of risk management and industrial policy compatible? This presentation will shed light on these questions by comparing the recent policies of California, China, the European Union, France, Germany and the United States.

## **Adaptation through risk-based decision making in mountain areas**

*Adrienne Grêt-Regamey (ETH Zurich)*

■ Mountain ecosystems and their inhabitants are particularly sensitive to global change. Their vulnerability will however depend on their capacity to cope with the impacts of these changes. Mitigation costs for risk reduction measures increasingly outweigh their benefits calling for more holistic approaches facilitating the implementation of cost-effective solutions and the prioritization of public investments for supporting the provision of various key services provided by mountainous areas, while guaranteeing a targeted level of security. In this contribution, we will present a new approach linking a collaborative virtual decision environment with a Bayesian Network for making risk trade-offs and inferring current development strategies in order to provide desired services in a case study region in Switzerland – the Landschaft Davos. The approach shows how stakeholder knowledge can be integrated in risk-based decision making for prioritizing regional investments – a base for resource management and planning guidance.

# WEDNESDAY 20<sup>TH</sup> JUNE

## **Nuclear waste and energy: public preferences, perceptions, and trust**

*Michael Greenberg (Edward J. Bloustein School, Rutgers University)*

■ The United States has nuclear and chemical waste legacy issues from both the nuclear weapons and nuclear power industries. A clear path to managing these legacy wastes has been obstructed by science and engineering challenges, nuclear proliferation concerns, high costs, and compounded because of the absence of a clear policy framework. The public hears inconsistent and often contradictory messages from advocacy groups, the mass media, and from government staff and elected officials. In order to better understand public preferences and perceptions about new nuclear missions at existing major US Department of Energy (DOE) sites and public preferences for alternative electric energy fuel sources, we surveyed US residents, disproportionately near six major DOE sites, in 2005, 2008, 2009, and 2010. In 2011, after the Fukushima events, another survey was conducted to determine the impacts of the Japanese event on the preferences and perceptions in the four earlier surveys. The major finding from the post-Fukushima survey was that the public was less willing to host new nuclear-related waste, energy and science facilities and that their preference for nuclear power moderately declined. More members of the public are more concerned about nuclear power than they had been. Those who remain supporters disproportionately worry about global climate change and trust the responsible federal agencies to safely manage the power plants and the waste sites. DOE, NRC, EPA, and owners and operators have relatively high trust, but it was reduced after Fukushima and these responsible parties need to take action to address their reduced credibility.

## **Fukushima: need for reappraisal of nuclear risks?**

*Wolfgang Kröger (ETH Zurich)*

■ The Fukushima Dai-ichi nuclear disaster was triggered by earthquake-induced tsunamis clearly exceeding anticipation and design limits. The flooding resulted in the loss of all safety equipment and functions and swept away all severe accident management measures implemented shortly before. Although some details are still missing or inconsistent today's available reports allow for tracing the course of event and related phenomenon and identifying the key deficits and failures, either technical, human or organizational-institutional. Beyond Fukushima "lessons-learned" will be addressed challenging the validity of the current safety concept and risk assessment of nuclear power plants.

# PRESENTATION ABSTRACTS

## M1 Moderators of risk perception

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Chair: Marie-Eve Cousin (ETH Zurich)

### **Psychological distance is dangerous, closeness is safe. How the construal level moderates the perception of individual risk and risk-taking behavior**

Eva Lerner (Ludwig Maximilian University of Munich), Bernhard Streicher (Ludwig Maximilian University of Munich), Rainer Sachs (Munich R), Dieter Frey (Ludwig Maximilian University of Munich)

■ Measuring subjective risk assessment is important for science, industry and the general public. Each decision people make implies an assumption about the probability of occurrence of the selected alternative. Therefore, this assumption is crucial to behavior. The research on Construal Level Theory (Trope & Liberman, 2010) has demonstrated that mental representations of events are influenced by the level of construal (CL). For example, the more distant an event is perceived, the more abstract the mental representation becomes (i.e., higher CL). In two studies the influence of CL on risk assessments and risk-taking behavior was investigated. In study 1 (N = 211) the CL was manipulated (high vs. low). Subsequently participants were asked to assess risks of 24 different scenarios (e.g., harmful consequences of nanoparticles) either for themselves or for another affected person. Subjects with high CL (abstract mindset) evaluated the degree of risks significantly lower than subjects with a concrete mindset, irrespective of whom the risks were related to (themselves or another target person). In study 2 (N = 87) the CL was manipulated (high vs. low) and subjects risk-taking behavior was measured using the Balloon Analogue Risk Task in a laboratory experiment. In the high CL condition subjects showed riskier performance than participants with a concrete mindset. Overall, results show that CL influences both risk assessment and risk-taking behavior. The perceived distance to an event, which is essential for the mental representation seems not only to be caused by

psychological distance, which is perceived by the event and its context, but also by the mindset's base level of construal. Therefore, for both risk assessment and risk-taking behavior it is decisive which CL is activated and which is appropriate to the respective situation.

### **Social thinking about collective risk and the three-dimensional model of personal involvement. Empirical studies in social psychology**

Andreea Ernst-Vintila (University of Reims, France)

■ Regardless of the progress of science and technology, one paradox subsists: when facing risk, humans appear to engage in seemingly irrational behavior. Social psychologists believe that, more than revealing cognitive biases, such a paradox unveils a specific psychosocial process: in social contexts, humans use a specific form of thinking, called *social thinking* (Rouquette, 1973).

The *Social Representations Theory* (SRT) is a theory of social thinking. Previous studies showed that 1) practices are a determinant factor in shaping the social representations of risks, and 2) personal involvement is a major explanatory variable of lay thinking. Personal involvement corresponds to an individual's relationship to a social object, such as risk. It is the result of three components: risk valuation, personal exposure, and perceived capacity to act.

Our *hypothesis* is that a change in personal involvement towards a risk triggers a change in its social representation. Are the operational aspects of the social representation affected in the same way as its normative aspects? We conducted empirical studies on collective risks such as natural hazards (earthquakes, tsunami) and man-made (nuclear power, terrorism). In all the studies we controlled participants' risk-related practice, and measured their personal involvement with regard to it. We analyzed social representations through standard procedures: prototypicality analysis and valency indexes.

In all cases *the social representations of risks displayed salient normative aspects and low functional orientation*. Such structures explain why the social thinking is non efficient in

guiding collective risk-related behavior (low collective prevention). However, the *social representations showed a significantly more practical orientation when participants cumulated solid risk-related practice (risk culture, training) and high personal involvement*. These empirical findings have consequences for risk prevention campaigns.

### **Risk and responsibility – presenting a pilot study**

*Johannes Brinkmann (Aalesund University College), Magne Aarset (Ålesund University College & ROFF, BI)*

■ Based on survey data collected autumn 2011 among car insurance customers of a Scandinavian insurance company, this paper analyzes and discusses the insured car drivers' attitudes towards risk and responsibility, and the association between the two. Since there seems to be a negative prejudice towards risk and a positive one towards responsibility, in general, it seems interesting to examine how these two key aspects of any insurance design are balanced, or combined otherwise.

Our analysis is rather conventional. Likert scale responses are summarized using exploratory factor analysis, and then controlled by relevant third variables, such as knowledge of insurance, role experience and self-confidence. Such and other causal relationships are also examined using LISREL. As an open end of the paper, we illustrate and discuss possibilities of grouping car insurance customers into four “C” segments, by their attitudes towards risk and responsibility (tending towards cowardice, carelessness, cautiousness or courage).

### **What is the real influence of knowledge on risk perception?**

*Marie-Eve Cousin, Angela Bearth, Michael Siegrist (ETH Zurich, Consumer Behavior)*

■ The risk perception of laypeople and experts differ for many new technologies, health hazards, and environmental hazards. A popular but not always successful strategy to overcome these discrepancies is to provide tailored risk information or knowledge to laypeople. Therefore, several studies about risk perception include knowledge as a key variable. However, the results found to date are as diverse as the operationalization and the methods used. There is no consensus about which operationalization of knowledge is most appropriate for risk research topics and whether the real importance of knowledge for risk perception is understood so far.

In a literature review, about 70 papers were identified that investigated the influence of knowledge on risk perception. The papers were analyzed with respect to problem fields and topics, operationalization, used methods, and results. Strengths and weaknesses of different operationalization approaches were analyzed.

It was found that the influence of knowledge differs considerably between the different studies. Identified operationalization varied from self-reported knowledge to very specific risk related knowledge items. Results suggest that the degree of specificity of the knowledge items plays an important role.

Further effort needs to be invested in methodological questions and considerations in order to understand the real influence of knowledge on risk perception. Implications of the found results for the design of future studies are discussed.

## **M2 Electromagnetic fields and public health risks**

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*Chair: Liesbeth Claassen (EMGO + Institute for Health and Care Research)*

### **Different roles of scientific experts in advising on environmental health risks**

*Pita Spruijt (RIVM/Utrecht University), Anne Knol (RIVM), René Torenvlied (Leiden University), Erik Lebrecht (RIVM/Utrecht University)*

■ Environmental health problems are often complex, large-scale, and uncertain. The uncertainties inherent in these problems provide leeway for differences in the appraisal of risks. This raises the question how experts interpret uncertainty and how this affects their policy advice. We present an exploratory study about different roles that can be discerned among scientific experts in the Netherlands. Q methodology is used in order to empirically explore two existing typologies on different expert roles. In total 26 electromagnetic fields (EMF) experts and 21 particulate matter (PM) experts participated. The responses were analyzed using factor analysis. The experts predominantly perceive EMF as a relatively certain risk and PM as an uncertain risk. Two sets of three different expert roles were found for both sub-domains. This suggests that the type of expert roles may depend on the specific research topic. The results indicate that different expert roles exist among



scientists who provide policy advice on environmental health issues. This first empirical study adds new data and insights to the literature on expert roles. When confirmed, the results of this exploratory study may be relevant for selection of expert committees or interpretation of expert advice.

### **Is wireless communication a health risk? Researching the scientific framing of a societal controversy**

*Marijke Hermans (Maastricht University)*

■ My presentation deals with the controversies around wireless communication technology which have mostly taken the form of local opposition against the siting of base stations. In examining this particular controversy social science research has focused on how risk perspectives from citizens, policy makers and scientists shape the controversy; and on how governments have reacted to (or fuelled) the controversy. I want to draw particular attention to the scientific framing of the controversy in terms of a 'health risk': despite a wide array of public concerns – ranging from landscape pollution and health concerns to lack of public involvement – a focus on health predominates. Based on a review of the social science literature and in-depth case study research, interviews, document analysis and participant observation of several cases of local mast siting controversies in the Netherlands and Belgium I argue that the health risk framing endorsed by policy makers and others entrenches itself in the public domain in two ways – further fuelling protests. Firstly, citizens who mobilize against base stations question the regulatory science with competing scientific evidence to tackle the issue in a legal-rational manner. Secondly, when citizens or interest groups are involved in public deliberations and share their wide-ranging concerns, the discussion nevertheless easily becomes restricted to a highly scientific and technical discourse. From a social constructivist perspective, I analyse what role (scientific) knowledge plays for citizens that are contesting a base station; how they gather this knowledge and what they do with it. I also analyse a 'new form of governance' in which Dutch 'critical groups' engage in discussions with policy makers, scientists and industry. I aim to better understand the mechanism that allows for public issues that are inherently social to be tackled as if they are purely scientific.

### **The relationships between trust in government policy, perceived control, and people's responses to public and personal sources of electromagnetic fields**

*Diana van Dongen (VU medical center/EMGO Institute for Health and Care Research), Liesbeth Claassen (VU medical center/EMGO+), Tjabe Smid (VU medical center/KLM Health Services), Daniëlle Timmermans (VU medical center/EMGO+)*

■ Trust in government policy affects the way people perceive and handle risks. In our study we investigated the relationships between trust in government policy regarding electromagnetic fields (EMF), perceived risk and perceived benefits of public and personal sources of EMF, and risk responses to the possible health risk of EMF (e.g. protest against placement of mobile phone base stations or power lines, or taking own measures against exposure to EMF). Previous research indicated that perceived risk and perceived benefits mediate the relationship between trust and people's responses to possible risks. Additionally, we suggest that perceived control over exposure to EMF affects the relation between trust in government policy and perceived risk, and therefore the risk responses. We performed a survey in the Dutch population (n = 1009). The survey contained questions about risk responses to EMF, perceived risk and benefits of several sources of EMF, trust in government policy regarding EMF, and perceived control over exposure to EMF. Comparing public sources of EMF, i.e. power lines and mobile phone base stations, to personal sources of EMF, i.e. microwave ovens, cordless and mobile phones, we tested our hypotheses. Variations in risk responses to both public and personal sources of EMF were mainly explained by perceptions of risk. In addition, perceived risk partially mediated the relationship between trust in government policy and risk responses. For public sources but not for personal sources of EMF, perceived control over exposure to EMF weakened the negative relationship between trust and perceived risk. We conclude that, especially in people with low perceived control, a lack of trust in government policy may enhance perceptions of health risks of EMF thereby inducing risk responses.

### **Assessing focal points for adjusting information about exposure to electromagnetic fields and health risks; a mental models approach**

*Liesbeth Claassen (EMGO + Institute for Health and Care Research), Ann Bostrom (Evans School of Public Affairs, University of Washington, USA), Daniëlle Timmermans (EMGO + Institute for Health and Care Research)*

■ In order to improve people's comprehension of health risks of exposure to electromagnetic fields (EMF) in daily life EMF, we assessed focal points for adjusting information about EMF, fitting people's existing ideas and beliefs. We used a descriptive mental models approach to assess both experts and lay beliefs about technical aspects of EMF, exposure to EMF in daily life, and potential health effects of EMF. First, an expert decision model was constructed based on a search of the relevant literature and interviews with 15 experts from different areas of expertise. Subsequently, we interviewed 12 lay people to identify gaps in knowledge and common lay beliefs. To quantify lay knowledge and beliefs among the general Dutch population, we then performed a survey (n = 403). Our results showed that lay people had little knowledge about the technical aspects of EMF and the relationship with personal exposure to EMF. Most participants believed exposure to EMF to be hazardous to health. However, reflecting the lack of consensus between experts regarding potential health effects there also was a high level of uncertainty among members of the lay public. Lay awareness of government policy on EMF was limited. Focal points for improving risk communication are the knowledge gaps about the nature and magnitude of EMF exposure in daily life, the uncertainty of the evidence for health effects, and information on governmental policy.

## **M3 Symposium: Nanotechnology risks – intersections across the social sciences**

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*Chair: Barbara Herr Harthorn (University of California Santa Barbara), Nick Pidgeon (Cardiff University), Terre Satterfield (University of British Columbia)*

Nanotechnology involves the fabrication, manipulation and control of materials and devices at the molecular level. Although they may bring benefits to society they have the potential for novel uncertainties and risks. As the paradigm 'emerging technology' of the early part of the 21<sup>st</sup> Century, there is also much to learn from the nanotechnology case about the social sciences of emerging risks – issues of risk perception, risk communication and risk governance. This symposium draws upon empirical and conceptual work conducted through the Center for Nanotechnology in Society at UC Santa Barbara (CNS-UCSB) and related initiatives. The presentations draw upon collective experience and empirical examples from work under CNS-UCSB and their colleagues, but also seek to interrogate wider questions about key social sciences concepts and issues in risk research which are illuminated through study of both the nanotechnology and other emerging risk cases.

### **Inequality, risk, and difference in deliberations about new technologies**

*Karl Bryant (State University of New York, New Paltz), Barbara Herr Harthorn (University of California, Santa Barbara)*

■ Risk perception research has found persistent gender and race effects, with recent studies suggesting that ideas about and perceived experiences of inequality, vulnerability, and justice (related, but not reducible, to gender and race) also play an important role in the formation of risk perceptions. How these matter, and what their relationship is, merits further study. Existing research in these areas has relied on survey data, which allows for robust statistical analyses and, depending on sampling method, generalizable conclusions about the study population. However, these methods also come with several limitations, including researcher-defined (instead of respondent-defined) risk categories, and limited ability to assess the diverse meanings that may be attributed to risk objects.

By contrast, we draw on qualitative data from a series of deliberative workshops on emerging nanotechnologies in order to examine more closely the relationship between social location, inequality, and risk perception. We extend extant scholarship by (a) looking

at more naturally occurring views expressed in a deliberative setting (as opposed to closed-ended survey response categories); (b) looking at the views expressed about inequality in the context of new (and future) technological development; (c) by providing a fine grained analysis of the relationship between views about inequality and respondents' social location; and (d) examining how participants do or do not link inequality up to questions of risk.

Our findings explore how existing inequalities serve as a fluid template for understanding inequality-related risks associated with new technological developments; how a range of ideas about distributional mechanisms shape ideas about both inequality and risk; the relationship between beliefs about the market and the formation of inequality-risk beliefs; and the way that techno-optimism and social-pessimism serves as an important nexus for the formation of inequality-risk concerns.

#### **Intuition, resilience and perceived environmental qualities in the case of engineered nanomaterials**

*Terre Satterfield (University of British Columbia), Barbara Herr Harthorn (UCSB Center for Nanotechnology and Society), Anton Pitts (University of British Columbia)*

■ Engineered nanomaterials and their perceived implications for environmental media can be understood in reference to multiple factors including a material's application domain, as well as any properties of the materials specific to the nanoscale. At the same time, nanomaterials can be understood as having environmental implications both across the life cycle and within different environmental media, colloquially, air, water and soil. This study examines the intuitive underpinnings of how nano-scale materials and their products, such as those based on carbon nanotubes, quantum dots, silver, titanium dioxide and zinc, are perceived in reference to their impacts on environmental media and their acceptability as the basis of new applications and products. Drawing from a recent US national web survey, we used psychometric scales to characterize the qualities that people intuitively assign to air, water, and soil with and without the presence of nanomaterials. Four factors – resilience, tangibility, sensory signature, and ephemerality of environmental media – emerged as primary. Resilience – defined in this study by the attributes: recovers easily from human impacts, self-cleaning, and easy to control – was a particularly powerful component of environmental risk perception and predictive or acceptability judgments across 14 different ENM applications. We then examine resilience in reference

to other known predictors of perceived risk, and suggest a greater mandate for explicit understandings of environmental risk perception as distinct from environmental values and perceived risks to human health.

#### **Moving upstream from nano to geo – public perceptions and geoengineering proposals**

*Adam Corner (Cardiff University), Karen Parkhill (Cardiff University), Nick Pidgeon (Cardiff University), Naomi Vaughan (University of East Anglia)*

■ 'Geoengineering' is the term used to refer to a range of technologies that could be used to deliberately intervene in the Earth's climate system, in order to moderate global warming. At this stage, most putative geoengineering technologies are merely ideas and proposals: they have not yet been researched or deployed in any meaningful way. But geoengineering raises a range of important social and ethical questions, and it has already attracted significant interest from members of the public and a wide range of stakeholder groups. In the 2009 Royal Society report on the geoengineering, a key recommendation was that a programme of upstream public engagement should be initiated. We outline the origins of this development in earlier deliberative work at the CNWS-UCSB with nanotechnologies, show how we have developed new methodological approaches, and report the initial findings of a series of public deliberative workshops on geoengineering in the UK, which focused on elucidating the key questions that members of the public would want to ask before making a judgment about any geoengineering proposal.

#### **Learning from labels on nanotechnology products**

*Ann Bostrom (University of Washington)*

■ Although some global advocacy groups have called for bans on nanotechnology applications and Canada recently banned nanotechnology in organic food production, there is little evidence that consumers are aware of these activities or even of the continued proliferation of nanotechnology applications. In a mental models study of nanotechnology participants (total N = 42) were asked to think aloud as they selected between sunscreens. The sunscreens varied in their labeling, although all had been previously identified by a consumer protection organization as containing nanoparticles. Most participants did not appear to register that the sunscreens had anything to do with nanotechnology, even after reading aloud terms such as "nano" on the label; they were surprised in later parts of the interview by the possibility of nanotechnology applied to sunscreens. The product

selection task think-alouds contrasted with participants' prolific ideas about possible applications of nanotechnology. Participants' characterizations of and inferences about nanotechnology were expressed primarily as beliefs about size (extremely small) and science fiction-derived ideas about nanomachines. In light of the aversion of some participants to the idea of using sunscreen containing nanoparticles it appears that nanoparticles may surprise even those who are aware of nanotechnology, in part due to inconsistencies with their existing mental models of nanotechnology. Findings are compared with other recent focus group and survey research.

## M4 Symposium: PACHELBEL I – Investigating and supporting policy-making for sustainable consumption in Europe

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*Chair: Tom Horlick-Jones (Cardiff University School of Social Sciences), Ana Prades López (CIEMAT-CISOT, Barcelona)*

Project PACHELBEL (2010–12) is supported by the EU as part of the F7 Environment Programme. The project brings together an experienced group of researchers, and combines conceptual and methodological sophistication with practical policy engagement. It addresses a number of themes to which the European risk research community has made significant contributions: environmental risk; sustainable consumption; risk perception & communication; citizen engagement; and risk-related policy-making and decision support. It is therefore especially appropriate for the PACHELBEL team to present its preliminary findings to the critical scrutiny of participants in SRAE12.

The project findings have been made possible by a series of action research interventions, in which the team has worked closely with policy-making organisations in six European countries, addressing live policy issues. The substantive issues range from sustainable transport to domestic energy consumption and shopping behaviour. These interventions have been used to trial a policy-making support tool called STAVE.

The symposium will comprise eight papers which address the key conceptual, methodological and practical findings:

- Understanding and supporting policy-making for sustainability: an overview of project PACHELBEL – Dr Ana Prades López
- Investigating the work of policy-making for sustainability – Lorenzo Marvulli
- Engaging with, and investigating, lay sustainability-related practices – Dr Wilfried Konrad
- Translating between social worlds of policy and everyday life: the STAVE tool – Prof Tom Horlick-Jones
- Issues and dilemmas of sustainable mobility from a citizen perspective – Dr Ann Enander
- The case of electricity 'smart meters' in France and Spain – Prof Marc Poumadère
- Filling the gap between discourse and action: the case of domestic consumption practices – Dr Josep Espluga-Trenc
- Citizens' understanding of energy consumption in Romania: the case of domestic insulation – Dr Marian Constantin.

### **Understanding and supporting policy-making for sustainability: an overview of project PACHELBEL**

*Ana Prades López (CIEMAT-CISOT), Tom Horlick-Jones (Cardiff University), Julie Barnett (Brunel University), Wilfried Konrad (DIALOGIK), Marc Poumadère (SYMLOG), Josep Espluga-Trenc (Universitat Autònoma de Barcelona)*

■ This paper will introduce the PACHELBEL symposium, which comprises presentations of a collection of papers reporting on the preliminary findings of this European (7<sup>th</sup> EUFP-funded) consortium project (2010–12).

The project is centrally concerned with a comparative understanding of the nature of policy-making practices concerned with sustainability – in particular sustainable consumption – and in developing a tool (STAVE) to support such policy-making. The work is being implemented by the project's nine partner institutions by means of a series of action research interventions in Spain, France, Germany, Romania, Sweden and the UK.

An important initial motivation for the project was recognition of the urgent need to develop practical ways to address anthropogenic climate change. We further recognised that it is not sufficient to simply tell people 'the facts' and expect them to behave 'sensibly'. Indeed the most interesting recent policy initiatives have taken a more sophisticated form than being simply about 'public education'. Rather, they include elements of com-

munication, advertising, incentives, and citizen engagement. Project PACHELBEL set out to better understand, and make a positive contribution to, such policy initiatives by means of actively engaging with both the policy-making process (collaborative action research interventions with our policy partners), and lay citizens (group-based research/deliberation/engagement process).

The STAVE tool was conceived as a ‘mini public engagement exercise’, with the capacity to tap into the practicalities of everyday lives, to generate knowledge on triggers and barriers to sustainable behaviours, and to explore the potential utility of possible policy initiatives. The tool has been developed and trialled in the context of live policy issues being addressed by our policy collaborators, such as sustainable transport, domestic energy consumption or shopping behaviours.

This overview paper will set out the range of the material to be covered in the symposium, and then consider its significance in the context of current themes within the research and policy-making literature.

### **Investigating the work of policy-making for sustainability**

*Lorenzo Marvulli (Cardiff University), Julie Barnett (Brunel University), Tom Horlick-Jones (Cardiff University), Afrodita Marcu (Brunel University), Ana Prades López (Centro de Investigación Energéticas, Medioambientales y Tecnológicas CIEMAT), Josep Espluga-Trenc, Alex Boso (Universitat Autònoma de Barcelona)*

■ This paper reports on comparative aspects of the real-world nature of policy-making for sustainability. As such, it is centrally concerned with the mundane work by which policy-making is practically accomplished on a day-to-day basis. Access to backstage features of this practical activity was made possible by virtue of the close collaboration necessitated by the action research interventions which have played a central role in the implementation of the European project PACHELBEL. These interventions have been focused on live issues with which policy-makers were actively concerned. Our data-gathering opportunities have ranged from informal conversations during visits to the offices of policy collaborators and exchanges during the course of collaborative work, to semi-structured interviews with policy-makers, and ethnographic immersion made possible by periods of workplace secondment. The paper considers the formal and informal aspects of collabora-

rating organisations’ policy-making styles and methods, and the resources utilised in carrying out their work. Finally, we consider our findings to the context of the existing research literature on policy-making, and themes which have a prominent role in contemporary discourse within policy circles.

### **Engaging with, and investigating, lay sustainability-related practices**

*Wilfried Konrad (Dialogik), Marc Poumadère (Symlog), Tom Horlick-Jones (Cardiff University), Ana Prades López (CIEMAT)*

■ The day-to-day behaviour of lay citizens plays a crucial role when it comes to coping with climate change. Their purchasing decisions as well as their everyday habits concerning the use of products or heating homes have major environmental impacts. Knowing how people reason about, and act in climate-related areas like domestic energy use, mobility, or product lifetimes, could be highly valuable for policy makers who aim to encourage consumers’ behaviours to be more environmental-friendly. This requires a sound empirical methodology that is able to tap deeply into people’s everyday lives. In project PACHELBEL a group-based research design has been developed and applied that consists of both reconvened meetings of the same group of citizens and diary keeping between these meetings. This approach creates the opportunity to initiate group interactions and individual reflections that elicits participants’ everyday practices by talking and thinking about one’s own experiences and learning from others’. The partners of project PACHELBEL have run 18 of such group processes in six countries, investigating sustainability-related practices in the fields of mobility, consumption, product lifetimes, domestic energy use, smart meters, and thermal refurbishment. On the one hand, the group discourses and diaries have been providing evidence about participants’ daily attempts to purchase consciously or save energy. On the other hand, the data collected reveals a broad range of structural and subjective obstacles that are rooted in lay citizens’ everyday lives and prevent them from behaving sustainably. This presentation will deliver insights into the substantial findings as to participants reasoning, practices and learning processes in the investigated areas, highlighting similarities and differences of the various national and thematic contexts. In order to present a lively picture of participants conversations, the findings will be enriched with extracts from the data collected.

### Translating between social worlds of policy and everyday life: the STAVE tool

Tom Horlick-Jones (Cardiff University School of Social Sciences), Ana Prades López (CIEMAT-CISOT), Jonathan Rosenhead (London School of Economics), Wilfried Konrad, Marc Poumadère (Institute Symlog)

■ This paper addresses the methodological challenge of seeking to design and operationalise a policy-making support tool. The tool has been designed to gain insight, in a relatively speedy and cost-effective way, into the practical detail of the everyday lived experience of people's lives. The tool is named Systematic Tool for Behavioural Assumption Validation and Exploration (STAVE). The development of STAVE has played a central role in the work of the European PACHELBEL consortium.

We will report on how the tool was first conceived, in the light of existing research literatures, and several bodies of research and practice. The STAVE design builds upon a number of cross-disciplinary traditions, including ethnography, focus group-based social research, citizen engagement practice, and problem structuring methods drawn from operational research and management science. The overall programme of work has been strongly informed by the Wittgensteinian notion of a language-game, and the associated insights into the interconnected roles of language and action in the practical accomplishment of everyday life. Kuhn's conception of 'translation' between different communities of practice, and Schön and Rein's related notion of 'frame reflection', have also been central to our thoughts.

We will then examine how the tool was assembled and trialled in the context of active real-world engagements with policy-making organisations. The STAVE trials were implemented in six European countries, where they were used to support live policy development across a range of sustainable consumption-related areas.

Finally, we will discuss the provisional findings of a comparative cross-country evaluation of the STAVE trialling process.

## M5 New approaches in risk assessment

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Chair: Steffen Foss Hansen (Technical University of Denmark)

### Nuclear power plant power system reliability and nuclear safety

Andrija Volkanovski (Jožef Stefan Institute)

■ The safety of nuclear power plant depends on the availability of a continuous and reliable source of electrical energy during all modes of operation of the plant. The loss of offsite power initiating event occurs when all electrical power to the plant from external sources is lost. A total loss of all alternate current power resulting from complete failure of both offsite and on-site alternate current power sources is referred to as a station blackout.

The results of a probabilistic safety assessment show that loss of offsite power and station blackout initiating events are dominant contributors to the core damage frequency of current plants, and this is supported by the Fukushima Daiichi nuclear power plant accident.

A new method for assessment of the nuclear power plant on-site power system reliability will be developed and presented. The method will be based on the fault tree analysis approach and will consider the actual configuration and functions of the on-site power system of the nuclear power plant. Both safety and non-safety related parts of the on-site power system will be considered in the method.

The analysis of the example, reference on-site power system for both safety and non-safety aspects will be done for normal operations as well as for the earthquakes of three intensities. The selected earthquakes, represented by their peak ground acceleration, will be ones related to the design basis safety shutdown earthquake, the maximum acceleration registered at Fukushima Daiichi nuclear power plant and assumed very strong earthquake. The obtained results will include the reliability of the on-site power system and most important components of the system.

Recommendations will be made on the basis of the obtained results considering the change of the design of the on-site power system and revision of the guidelines for the assessment of the station blackout coping capability.



### **Development of a risk analysis methodology for research and teaching laboratories**

*David Pluess, Amela Groso, Thierry Meyer (EPFL Lausanne)*

■ Available risk analysis techniques are well adapted to industry since they were developed for its purposes. Most of the hazards present in industry exist also in academia/research although the scales are often smaller. However, some characteristics of the occupational environment are notably different (equipment and techniques are mainly experimental, high turnover of collaborators, rapid reorientation of research programs, etc.). Classical approaches for risk analysis require a lot of resources and well-defined processes. Therefore they are of limited use in such complex systems.

The risk diversity in academic research has increased rapidly during the past decades. At the same time, public risk acceptability has decreased caused by various severe accidents. Due to the organizational differences between academia and industry, limited resources are available in research institutes. For this reason, there is a need for a suited, research specific, risk analysis technique. A new methodology should be easily performable by non-experts and less resources consuming than existing techniques.

This current work presents a new approach for risk analysis and ranking in research laboratories. The commonly accepted dimensions of risk quantification (probability, severity, detectability) are therefore modified and advanced in order to suit the demands of research and teaching laboratories. Additionally, the risk perception is taken into account, since it is of high importance when dealing with new technologies. The methodology, in which the risk is a nonlinear function, provides a more precise risk calculation compared to widely used methods in semi-quantitative risk analysis techniques.

Based on this technique, we developed a web application that includes an upgradeable database and interactive, user-friendly, intuitive interface allowing evaluating and quantifying risks. Moreover, even non-experts will be able to perform informative risk analyses in a short amount of time.

### **A combined AHP-crisis tree analysis-mathematical programming approach to evaluate and prevent disasters**

*Alessio Ishizaka, Ashraf Labib (University of Portsmouth)*

■ Disasters happen regularly and it is essential to learn from them in order to prevent new ones. This paper presents a three step method for an optimised safety investment. First, it introduces a new graphical representation, the Crisis Tree Analysis (CTA), to map

the combination of basic events leading to a crisis. Secondly, the criticality of each event is assessed using the Analytic Hierarchy Process (AHP), which permits to prioritise tangible and intangible basic events on the same scale. Finally, a mathematical programming model allows the optimal allocation of funds to avoid a crisis. The Bhopal disaster is used as a study case in order to illustrate our three steps method

### **Pro et con analysis of existing ranking and occupational risk assessment concepts for Nanomaterials**

*Steffen Foss Hansen (Technical University of Denmark), Keld Alstrup-Jensen (National Research Centre for the Working Environment), Anders Baun (Technical University of Denmark/DTU Environment)*

■ There is an urgent need for adaptive, transparent, easy comprehensible and communicational and yet robust scientific methods, approaches and frameworks to evaluate the potential of exposure, hazard and risk related to the production and application of nanomaterials. A number of alternatives or supplements to traditional risk assessment have been explored and proposed in recent years. Examples of these include the "Control Banding Nanotool" developed to assess and control the risks of nanomaterials and the more holistic "Swiss precautionary matrix". In this paper we review these and other tools and discuss various elements of the tools (input data requirements, risk evaluation and risk handling) as well as pros and cons. We find that most of the tools provide a transparent and comprehensible approach and a few include risk management and communication going well beyond what is normally considered in traditional risk assessment. Most of the concepts available today however, is that their input data requirements are fairly high and some of the scientific information needed in order to apply them is inconclusive at the moment or non-existing. Some of the concepts are furthermore based on purely theoretical considerations and time-consuming to apply in reality. We provide a set of recommendations for what regulators and risk assessors need to consider before selecting and applying one or the other tool in a given situation and call for further application and development of these tools in the support regulatory decision-making.

# M6 Symposium: Multicriteria methods to address risk, uncertainty, and complexity in environmental decision making

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*Chair: Judit Lienert (Eawag: Swiss Federal Institute of Aquatic Science and Technology), Joseph Arvai (Haskayne School of Business, and Institute for Sustainable Energy, Environment, & Economy (ISEEE), Univ. of Calgary, Canada), Ian Durbach (Department of Statistical Sciences, University of Cape Town, South Africa), Timo P. Karjalainen (Thule Institute, University of Oulu, Finland)*

Environmental issues routinely force our society into making difficult decisions. The decisions may affect stakeholders with conflicting perspectives, and trade-offs must be made. Risks and uncertainties are usually large; available data being limited, the decision maker's preferences under uncertainty unknown, and predictions about environmental risks highly uncertain. Multi-Criteria Decision Methods (MCDM) address such problems. However, despite a long tradition, applying MCDM in complex, real decisions remains a challenge. In this symposium we present research at the interface of theory and application that aims at closing relevant gaps. J. Arvai strives to make multi-criteria risk management consultations more relevant for local people. He demonstrates how the needs of local stakeholders and decision makers can be directly addressed, and how people can become more engaged in risk management decisions with the help of MCDM. In environmental contexts, stakeholders must understand that decisions entail risk and uncertainty – the focus of the work of I. Durbach. Based on simulation and behavioral experiments, he discusses how different formats for representing uncertainty can influence the MCDM process. T. Karjalainen draws on a broad experience of MCDM applications in watercourse regulation, flood risk management, and river basin management in Finland. He discusses the effectiveness of advice provided by MCDM in these projects and postulates that good decisions should be perceived by stakeholders as demonstrating credibility, salience, and legitimacy. J. Lienert, finally, presents a project from Switzerland where stakeholders are involved in complex water infrastructure decisions with the help of MCDM methods.

To address the uncertainty of the future, MCDM is additionally combined with scenario planning. We hope that the four talks stimulate discussions about good ways to minimize the risks of environmental decisions, regardless of what awaits us in future.

## **Multi-criteria methods as analytic-deliberative approaches: an analysis of effectiveness of advice in environmental and risk management**

*Timo P. Karjalainen (University of Oulu), Mika Marttunen (Finnish Environment Centre)*

■ Due to high degree of complexity, uncertainty and ambiguity in many areas of environmental policy and risk management, a combination of thorough analysis and informed deliberation is clearly useful and important for environmental decision making. It seems that we need methodological solutions which, on the one hand, allow citizens and stakeholder groups to participate in their own terms and expertise, and which, on the other hand, can be used to make information (originating from different sources or disciplines) commensurate for environmental decision-making. Multi-criteria decision analysis methods are increasingly used to facilitate both rigorous analysis and stakeholder involvement. MCDA has been applied in many different ways in different contexts. There are examples of innovative interdisciplinarity and transacademic collaboration in the process, and scientists and analysts in these cases can be seen as 'honest brokers' opening up different views and policy options. However, the use of MCDA in a truly participatory way and tailoring it to the needs of the decision problem is a challenging task and requires careful design and expertise related to methodology and process. This paper discusses and evaluates the effectiveness of advice provided by multi-criteria methods and processes, in particular decision analysis interview (DAI) approach, in environmental planning. This evaluation is based on the concept of assessment effectiveness. According to that idea assessments and advice is most likely to be effective in influencing decision making to public issues to the extent that they are perceived by their audience and relevant stakeholders as demonstrating credibility, salience and legitimacy. The analysis of effectiveness of advice is based on the real-life watercourse regulation, flood risk management and river basin management projects in Finland.



### **Tools for representing uncertainty in decision aid: evidence from simulation and behavioural experiments**

*Ian Durbach (University of Cape Town)*

■ Uncertainty is present in many decisions where the outcomes of possible courses of actions are unknown because they will only be realized at some point in the future. In this talk some formats for representing uncertainty are presented, including probabilities and probability-like quantities, expectations and variances, quantiles and scenarios. Evidence from simulation and behavioural experiments is used to draw broad conclusions about how the choice of uncertainty format can influence the multi-criteria decision process, in terms of the final outcomes as well as the way in which information is processed. The results suggest that most uncertainty formats can return good results, but that the use of a small number of quantiles is particularly promising as a general-purpose tool for handling uncertainty in multi-criteria problems.

### **Making hard decisions to ensure safe water supply and wastewater disposal in uncertain futures**

*Judit Lienert (Eawag: Swiss Federal Institute of Aquatic Science and Technology)*

■ Urban water infrastructures are under pressure, even in rich OECD countries as Switzerland. The urban water system is of core importance for providing clean drinking water, for urban hygiene, and water pollution control. However, the pipes and treatment plants, which are designed to last over decades, are ageing, and they must also deal with new environmental pollutants such as pharmaceuticals. Planning water infrastructures is demanding. Not only do we have to make large financial investments to ensure the functioning of the system, we also need to anticipate the future in a fast-changing world. What are the risks to our society in 2050, what will our world look like, and how can we ensure the safe supply of drinking water and disposal of wastewater? SWIP – Sustainable Water Infrastructure Planning – is a new project that attempts to approach such questions by combining engineering expertise with Multi-Criteria Decision Analysis (MCDA). In this talk I shortly present the background, project goals, and the general research approaches. I then focus on the use of MCDA and scenario planning as good tools to involve stakeholders and deal with risk and uncertainty. In two stakeholder workshops, we set up

an objectives hierarchy that includes obvious goals such as “safe disposal of wastewater” or “protect water bodies”, as well as less obvious ones as “intergenerational equity”. We also generated a broad range of decision alternatives. The stakeholder participants created four future scenarios, ranging from “boom” over “sustainable growth” and “status quo” to a “doom-world” in 2050. As next step, the subjective preferences concerning the achievement of goals will be elicited in stakeholder interviews. In this talk, I will discuss how we use the scenarios and the subjective preferences of stakeholders to make sound decisions for water infrastructures today that will – hopefully – prove to be sustainable also in tomorrow’s world.

### **Coming out from behind the computer: multicriteria approaches for more meaningfully engaging local stakeholders in consequential risk management decisions**

*Joseph Arvai (University of Calgary)*

■ It is now widely accepted that stakeholders and decision makers of all stripes must be involved in multicriteria risk management initiatives. To this end, much work has been done to address the need for more comprehensive science-based inputs that address key uncertainties and inform risk management decisions. Likewise, research has been focused on understanding the values that affected stakeholders associate with environmental degradation and protection. And, practitioners have worked to bridge the gap between technical assessments and communities by promoting participatory approaches as a means of improving environmental decision making. In spite of these efforts, however, important obstacles to more meaningful stakeholder engagement, and better decisions, persist. Most notably, very little attention has been paid to developing multicriteria methodologies that would more directly address the stated needs of decision makers and stakeholders involved in risk management consultations. To address this gap, I will discuss recent work aimed at making multicriteria risk management consultations more “decision relevant” for people at the local level; that is, helping people to better contextualize information in light of often conflicting risk management priorities, and then confront the inevitable tradeoffs that arise when they must choose among competing risk management alternatives.

## M7 Perceiving and understanding risk

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*Chair: Margôt Kuttischreuter (University of Twente)*

### **International survey of knowledge of mobile phone specific absorption rate (SAR) information among mobile phone users**

*Dagmar Wiebusch (Informationszentrum Mobilfunk e. V.), Jack Rowley (GSM Association), Chris Althaus (Australian Mobile Telecommunications Association), Michael Milligan (Mobile Manufacturers Forum)*

■ SAR, a measure of the amount of RF power absorbed, is used to determine a phone's compliance with exposure limits. Variations in SAR do not mean that there are variations in safety as all mobile phones must meet RF exposure guidelines. Nevertheless in public debates SAR is often misleadingly used as a safety indicator. Furthermore some authorities require displaying the SAR value on a phone's package as consumer health information.

To assess public awareness of specific absorption rate (SAR) information for mobile phones, consumer understanding of SAR and the importance of SAR information in purchase decisions we participated in an international survey. The survey was conducted by the GSM Association, Australian Mobile telecommunication Association, Mobile Manufacturers Forum and Informationszentrum Mobilfunk e. V. It was carried out in 2011 in nine countries (Australia, Brazil, Chile, France, Germany, India, Japan, Switzerland, USA) with 4,852 participants.

We found that on the average concern about possible health risks from using mobile phones was generally low (24%) across all countries. SAR as well played only a limited role for consumers: 25% said that they were aware of it. There was greater awareness among concerned persons (34%). When asked to explain SAR, only few persons were able to expand the SAR acronym and about 50% of respondents interpreted SAR falsely as a safety indicator. In purchase decisions, SAR rated lowest of 21 pre-defined factors. Only about a fifth (19%) of respondents said that they knew where to find SAR information for their mobile phone.

We conclude that there is a widespread misunderstanding of SAR that complicates the public debate about safety of mobile telephony and may be jointly responsible for public health concerns particularly of already worried persons.

### **Psychosocial effects of new power lines: design of a longitudinal field study**

*Jarry Porsius (EMGO+ Institute for Health and Care Research, VU University Medical Center), Liesbeth Claassen (EMGO+ Institute for Health and Care Research, VU University Medical Center), Fred Woudenberg (Municipal Health Service Amsterdam), Tjabe Smid (EMGO+ Institute for Health and Care Research, VU University Medical Center, KLM Health Services), Daniëlle Timmermans (EMGO+ Institute for Health and Care Research, VU University Medical Center)*

■ Many people worry to some extent about the health risks of electromagnetic fields (EMF) emitted by power lines. Although most experts agree that exposure to EMF from power lines is generally safe, some studies report small associations between living in close distance to power lines and the prevalence of childhood leukaemia and Alzheimer's disease. As demand for a reliable supply of electricity increases, new high voltage power lines will be introduced in the environment. This may conflict with public concern over EMF exposure as demonstrated by the many local protests against the introduction of these power lines. In the next decade, new power lines are going to be built in the Netherlands. This provides an opportunity to research the psychosocial effects of new power lines in a prospective manner. We will present the design of a quasi-experimental longitudinal field study to test how the introduction of a new high voltage power line affects risk and health perceptions of residents living close to the new power line compared to residents living farther away. When residents feel exposed to EMF from the new power line and have negative health expectations of this exposure we expect to find an increase or re-attribution of somatic complaints after the commissioning of the new power line (nocebo and attribution effect). Results of this study may be used to advice policy makers on risk communication strategies.

### **The concept of emerging infectious diseases revisited: new challenges for understanding and communication of risks**

*Marcia Grisotti (Federal University of Santa Catarina), Fernando Dias de Avila Pires (Oswaldo Cruz Foundation/Tropical Medicine Department)*

■ The expectations surrounding the conquest of infectious and parasitic diseases with the advent of the theory of the microbial origin of infectious diseases followed by the production of serums and vaccines at the end of the 19<sup>th</sup> century and by the discovery of

sulfas and antibiotics in the 20<sup>th</sup> century did not fulfill our optimistic expectations. The emergence of AIDS and of a number of zoonotic diseases at the end of the 20<sup>th</sup> century disproved the concept of an epidemiological transition.

Microorganisms are versatile, and display a wide array of adaptations to adverse environmental conditions both in the external world, as in the internal milieu of their hosts. Advances in our understanding of their biological processes, in the production of new generations of antimicrobial drugs and vaccines, and in the improvement of effective barriers to their dispersal is actually slower than the possibilities of mutation, recombination, and dispersal shown by microorganisms.

In this context, the concept of emerging infectious disease arose. However, an analysis of the literature points to existing ambiguities in this concept. This paper reviews the concept of emerging infectious disease, departing from the accepted definitions adopted by the Centers for Disease Control (CDC/USA) and the complex definition suggested by Grmek (1995). The debate centers on the meaning of an emerging infectious disease: What does a new disease mean? When can we recognize it as an emergent one? Was it unknown so far from science and medicine, or is its agent a new species, which had no previous history on the Earth? Is it new in a certain region? Did it re-emerge after a long period of absence? How recognize it as new or emergent one? A disease is the same in distinct hosts, human and non-human, or even in different individuals?

In order to illustrate the concept of emergence and the social construction of its risks, we present two case studies – bovine tuberculosis, abdominal angiostrongyliasis.

#### **Lyme disease: risk perception and information seeking**

*Margôt Kuttschreuter (University of Twente)*

■ In recent years, the number of ticks in the Netherlands has increased, and so has the incidence of Lyme disease. This calls for initiatives to inform the general public about the risk and effective protective measures. This is especially relevant in the case of parents of young children. In order to develop effective communication messages and strategies, knowledge is needed on parents' perception of Lyme disease, and on what stimulates them to take notice of messages related to this risk.

Based on the Protection Motivation Theory and the Risk Information Seeking and Processing model relevant variables were identified. A cross-sectional survey has been carried out among parents of children under the age of 13 (n = 150). Parents were questioned

regarding their perceived knowledge of Lyme disease, their risk perception, anxieties, their risk reducing behaviours, their perception of the efficacy of these behaviours, their need for information and their information seeking behaviour. All variables were measured reliably on a 5-point Likert scale.

Preliminary results showed that thinking about the risks of their child catching Lyme disease made parents feel uneasy. They considered it somewhat hard to carry out the recommended behaviours. In general, they did not reduce their child's exposure to situations in which (s)he might be tick bitten, but rather concentrated on checking their child after exposure. Some 60% indicated they would like to have more information on Lyme disease and that they would try to find out more in case they heard something about its risks.

Information seeking was found to be significantly correlated with information need and social pressure to be informed in particular, whereas protective behaviour correlated most highly with the perceived efficacy to carry out these behaviours.

The results of regression analyses predicting information seeking and protective behaviour will be presented and implications for risk communication will be discussed.

## **M8 Risk and the media: investigating the EHEC outbreak**

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*Chair: Julie Barnett (Brunel University)*

#### **The impact of the news coverage of the EHEC-outbreak on risk perceptions using the Extended Parallel Processing Model**

*Melanie De Vocht, Verolien Cauberghe, Benedikt Sas, Mieke Uyttendaele (Ghent University)*

■ This study reports the affective and cognitive reactions to the written online news coverage in Belgium of the EHEC outbreak in May/June 2011. The outbreak of the deadly EHEC-bacteria was situated in Germany but also affected citizens of other European countries which had a history of travelling to Germany. It resulted in the loss of 50 lives and in 857 cases of Haemolytic Uraemic Syndrome, which leads to acute kidney failure. This outbreak was reported as one of the most severe outbreaks in Europe, caused by fresh pro-

duce. Using the Extended Parallel Processing Model (EPPM) of Witte (1992) as theoretical framework, the study explores the impact of Belgian news coverage of the EHEC bacteria on the different concepts of EPPM, c.q. perceived severity, susceptibility, efficacy, and affective responses. When news coverage started on the EHEC-outbreak, a link was inserted below every online newspaper article on the EHEC outbreak of 2 substantial Belgian newspapers. The online survey measured, in addition to the EPPM concepts, also the behavioral intention to eat less fresh produce, the intention to rinse better, trust and relief, using a 7-point Likert scale. This way the first perceptions and reactions on the EHEC-outbreak were collected. Reactions of 6524 respondents were gathered within 9 days, and this for 16 different online newspaper articles. The mean age of the sample is 40.89 (SD = 13.80, range: 13–88years) of which 47.6% is male. The results show that the measured concepts significantly differ over time. The online survey was combined with a qualitative content analysis of the 16 news articles. In this analysis the articles were examined using the components of EPPM. Combining the results of the survey with the content analysis allows us to link the individuals' reactions to certain aspects of the content of the news articles. As such several hypotheses based on the EPPM could be tested. Conclusions and managerial implications are discussed.

#### **Communication of a food alert. The case of the so-called “killer cucumbers”**

*Gema Revuelta (Universitat Pompeu Fabra), Gloria Cugat (Agencia Catalana de Seguretat Alimentaria), Veronica Escurriol (Science communication observatory), Patricia Gosálbez (Agencia Catalana de Seguretat Alimentaria)*

■ In case of a food alert, information provided by official sources, especially in the initial moments, is decisive in its social consequences. We analyzed the crisis of the so-called Spanish "killer cucumbers", which took place in May 2011 and was originated after the Hamburg health authorities reported that the source of a serious outbreak of E.coli intoxication could be a lot of cucumbers from Spain.

This case was examined by content analysis of mass media (seven newspapers and two television channels broadcasting in Catalonia, Spain) and press releases from the main European and national organizations responsible for managing the food crisis. In addition, we analyzed, by the analytical tool Google insights the search for information by Spanish citizens.

The initial information emitted from the Ministry of Health of Hamburg was broadcast on the first day by all the Spanish media studied, without doubting it. The term "killer cucumbers" accompanies the information in some media. Information also circulated profusely through social networks and blogs. From the second day, critics about the lack of evidence were published. Although the German authorities publicly rectified their initial information, cucumbers continued to be present as an icon throughout the crisis (in headlines, contents and images). The behavior search for information in Google by Spanish citizens confirmed that the word "cucumber" was still present throughout the crisis. Spanish cucumber consumption declined drastically throughout Europe. This case shows the serious consequences of irresponsible management of communication in a case of a food alert.

This case has been analyzed in the context of the SAM report (Seguretat Alimentaria i Mitjans, meaning Food Safety and Media) a project which aims to improve the information that society receives on food safety and food security issues.

#### **Social media and communication of risk: the case of EHEC/E-coli**

*Julie Barnett (Brunel University), Timothy Cribbin (Brunel University), Aine Regan (University College Dublin), Rui Gaspar (ISCTE – Instituto Universitário de Lisboa)*

■ The nature of the relationship between official risk communications and the actions and attitudes of other stakeholders has been a clear theme in the risk literature for the last 30 years as well as a topic of practical interest to those charged with communicating the advice of government and associated agencies about risk issues. The role of the media in this relationship has always been considered crucial and the centrality of the media in amplifying risk perception and associated behavioural impacts (whether in terms of intensification or attenuation) is clearly reflected in the mechanisms proposed by the Social Amplification of Risk Framework (SARF). Although SARF, and the nature of the role assigned to the media has attracted some criticism, it undoubtedly remains the primary conceptual 'scaffolding' within which considerations of the impact of risk communication and the role of the media are aligned.

The exponential rise of social media and the associated increase of technological capability for tracking, analysing and visualising this, offers new opportunities to reflect on the relationship between social media and other indicators of risk appreciation. We will present data that highlights some early considerations of this in relation to the 2011 outbreak

of Enterohaemorrhagic Escherichia coli (EHEC/E-coli) in which 50 people died and over 900 people had severe kidney damage or kidney failure. The risk communication activity accompanying this incident was characterised by conflict and uncertainty. The cause was linked to various salad vegetables, particularly focusing on Spanish cucumbers before the likely culprit was identified in late June as dried fenugreek seeds.

The data set of social media output (SMO) pertaining to the UK was collected between May 12th August 12th 2011. There were 30,884 data units, each a product of online news, a microblog, forum, facebook a video or blog. Text mining was used to generate spatial-semantic visualizations of SMO at different intervals surrounding the release of official government statements. Interpretation of these views was facilitated using a form of burst analysis to extract and quantify the relative salience of key terms that characterised the dominant themes at each interval. This analysis thus seeks to identify trigger points for heightened media activity and the ways in which the nature of this activity differs in across the various types of social media. The implications of this for SARF are discussed.

## Mg Nanotechnology

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*Chair: Sharon Friedman (University of Twente)*

### **Consumer perceptions of nanotechnological applications in food and agriculture**

*Amber Ronteltap (Wageningen University and research center), Rob van Veggel (Wageningen University and research center), Jantine Voordouw (Wageningen University and research center), Daniella Stijnen (Wageningen University and research center), Arnout Fischer (Wageningen University)*

■ Nanotechnology allows for innovative applications in agriculture, food production, and food packaging. However, the potential risks and benefits, and the uncertainty related to nanotechnology makes the societal response to the products and the technology as a whole uncertain. It has been argued that it is the societal response that contributes to the success or failure of the introduction of new technologies. For acceptance of technology-based food innovations risk and uncertainty perceptions, cost/benefit considerations, subjective norm and perceived behavioural control are important constructs in the inter-

pretation and evaluation of novel food technologies. Qualitative data is suited to investigate context dependent interpretations of risk and benefits. A series of semi-structured interviews was conducted using mood boards and scripts to elicit the relevant opinions. Transcripts of the interviews were analysed using Atlas it software. Consumers showed little knowledge about nanotechnology. Consumers interpreted nanotechnological applications largely in the context of their use and reported context dependent benefits, costs and risks for different stakeholders. Frequently reported risks involve health risks as nanoparticles might enter the body or end up in environment. Additionally consumers reported the potential raise in product price and increase of waste. Consumers perceived benefits in nanotechnological applications to improve the quality of products, such as nutritional value or flavour, and reduced pesticide use. Consumers also reported benefits of nanotechnology to enhance the 'naturalness' of products compared to other human interventions. Consumers acknowledge the complexity of risks, benefits, and costs related to nanotechnology. Despite the uncertainty of the risks the consumers do not reject nanotechnological applications. At this point, nanotechnology does not seem to be an important issue for consumers.

### **Understanding public risk perception of nanotechnology**

*Zhen Ge, Guodong Sun (Stony Brook University)*

■ Nanotechnologies can be applied to a variety of areas of usage, and have developed rapidly in recent years. For instance, they have great potentials in improving the efficiency of clean energy technologies. Nanoparticles emitted from the production and use process, however, can have significant adverse effects on public health and the environmental safety.

Public perceptions toward these effects play an important role in policy making and can steer the future development of those technologies. Communicating risks of nanotechnologies to the public is thus particularly important.

Communicating risks to lay people effectively requires a good understanding of what they know and don't know about the technologies. However, not only do the general public know little about nanotechnology, researchers know even less about what the public know and do not know about this technology.

Most studies up-to-date examined public's perceptions of nanotechnology by framing it in a broad way, as opposed to specific applications. Later studies show that public risk perceptions of nanotechnology vary based on the usage of areas.

In this study, we use carbon nanotubes, one type of nanoparticles as a case study. We adopt the mental model approach as a tool to identify the knowledge gap between expert knowledge and lay people's intuitive risk perception. First, we review current literature on the risks of carbon nanotubes and build expert mental model with influence diagrams. Then based the influence diagrams, we conduct in-depth interviews with lay people and construct their mental models. Finally, by comparing expert and lay people's mental models, we expect to identify missing knowledge links in public perception of nanotechnology and then design risk communication that addresses these issues.

#### **How to regulate and communicate nanomaterials' health risks in the face of uncertainty?**

*Anja Dijkman (TNO), Anne Dijkstra (University of Twente), Cees van Woerkum (Communication sciences Wageningen University), Jeroen Terwoert (TNO)*

■ Companies are legally obliged to prepare risk assessments and to take measures to control health risks to workers where needed. Furthermore, workers should be informed and instructed, on the basis of the risk assessment. This applies to nanomaterials as well. However, current knowledge of hazards and exposure of nanomaterials is far from complete. Preliminary experiences with risk assessment in the Netherlands have learned that not all answers are available yet. This situation increases uncertainty, questions, and discussions between major stakeholders such as companies, Labour inspection, and policy makers. Will risk governance offer broader perspectives?

A stakeholder dialogue was organized to start up a process of risk governance with the aim to qualitatively analyse and frame issues regarding health risks of nanomaterials. Companies exchanged first experiences with risk assessment and management of nanomaterials. The need and potential for additional agreements or facilities – e.g. the establishment of a permanent platform for deliberation – was discussed.

Results show that the key issue seems not to be the lack of knowledge itself, but the issue of regulating uncertain health risks. Opportunities for translating current governance models into practical guidance for the governance of uncertain (Nano) risks at company-level are considered.

#### **Debating nanotechnology regulation and risks in the U.S. and U.K. media**

*Sharon Friedman, Brenda Egolf (Lehigh University)*

■ Debates about whether and how to regulate nanotechnology involve many stakeholders including industry leaders, politicians, nongovernmental organizations, scientists and engineers, lawyers and others. Despite different and competing motivations, they "all appear to genuinely believe that they best represent the interests of citizens." (1) Yet, many studies have shown that despite some "upstream" attempts at policy dialogues, most citizens have little information about nanotechnology, let alone potential regulatory strategies. Evaluating mass media coverage of regulation provides a way to see how much information about nanotechnology regulatory activities has been available to interested readers. This paper will examine two types of mediated regulation information connected to issues of health and environmental risks. One type comes from a longitudinal study of regulation information from traditional media, while the other presents an analysis of information from an Internet newcomer to nanotechnology risk coverage. The longitudinal study focuses on coverage in U.S. and U.K. newspapers and wire services of nanotechnology regulation related to health and environmental risk issues from 2000 to 2010. As part of this discussion, various groups in these media articles that have called for new or tightened regulations will be highlighted, as well as the types of risks that have led to calls for regulatory action. The Internet analysis will review risk and regulatory information published during 2010 by a nanoblog in an online U.S. newspaper, the New Haven Independent. Sponsored by a foundation, this blog is written by professional journalists and it appears to be an increasingly important source of comprehensive nanotechnology news in the United States.

(1)"Introduction: The Regulatory Challenges for Nanotechnologies," G.A. Hodge, D.M. Bowman, A.D. Maynard in *International Handbook on Regulating Nanotechnologies*, 2010.



# M10 Symposium: PACHELBEL II – Investigating and supporting policy-making for sustainable consumption in Europe

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*Chair: Tom Horlick-Jones (Cardiff University), Ana Prades López (Cisot – Ciemat Barcelona)*

## **Is being smart enough? The case of electricity 'smart meters' in France and Spain**

*Marc Poumadère (Institut Symlog, Paris, France), Raquel Bohn Bertoldo (Institut Symlog, Paris, France), Alex Boso (Cisot – Ciemat Barcelona, Spain), Josep Espluga-Trenc (UAB: Universitat Autònoma de Barcelona, Spain), Christian Oltra (Cisot – Ciemat Barcelona, Spain), Claire Mays (Institut Symlog, Paris, France), Ana Prades López (Cisot – Ciemat Barcelona, Spain), Nina Schneider (Institut Symlog, Paris, France)*

■ As part of its sustainability policy, the EC has proposed that 80% of European households have access before 2012 to smart information systems. The goal of such system is to better manage electricity savings, through more precise citizen information, varying rates according to consumption, and facilitation of competition. In France, after an experimental phase with 250 000 households, a national program is set to equip 35 million households with a new meter (Linky). In Spain, there is an increasing interest among local administrations and companies in the installation of smart meters to homes and small businesses.

Some benefits of this new technology are clear for both the citizens and the electricity operator, such as the ability to initiate service, change subscription, or make a meter reading from a distance. Some questions arise however about the policy assumptions regarding citizen engagement: are economic incentives and disincentives the essential determinants of action? Is factual information enough to induce the expected energy consumption changes? Are there specific consumer perceptions, demands or concerns which have been overlooked or ignored?

Trying to answer these questions is part of the PACHELBEL project and is achieved through a quasi-naturalistic approach. A specific engagement process (STAVE) has been applied with 3 groups in France composed of persons whose households were recently equipped with a new smart meter during the experimental phase. In Spain, the STAVE tool

was applied to analyse and compare energy saving behaviours and attitudes in two groups, one of them composed of individuals that installed a smart meter in their households.

Results of the structured group process show the importance of everyday life considerations in the actual use of the smart meter. Pragmatic constraints on improving sustainable consumption are identified, such as citizens' attitude that they are already trying to save as much electricity as possible even without the meter. Concern for other sustainable consumption issues (such as obtaining public transportation in the rural area) is mentioned, together with the wish for a more coherent overall policy of energy conservation (involving all societal actors, including institutions).

## **Filling the gap between discourse and action: the case of domestic consumption practices**

*Josep Espluga-Trenc (UAB), Julie Barnett (Brunel University), Ann Enander (Swedish National Defence College), Susanne Hede (Swedish National Defence College), Tom Horlick-Jones (Cardiff University), Wilfried Konrad (Dialogik), Afrodită Marcu (Brunel University), Lorenzo Marvulli (Cardiff University)*

■ There is often a wide gap between what people say about sustainability (discourses) and what they actually do (actions). This makes the development of appropriate sustainable policies difficult. The PACHELBEL project has attempted to capture evidence on people's everyday behavior so as to better understand this gap between talk and action.

In this paper we present some results on behaviors and discourses related to consumption practices (domestic energy consumption and the purchasing of white goods). The results have been gathered from four European countries: Germany, Spain, Sweden, and UK. The research has followed two tracks: On the one hand, through an ethnographic approach, we analyzed the policy makers which are promoting sustainable consumption. On the other hand, we have analyzed the behavior, habits and discourses of target citizens of those policies. For this we have selected a qualitative sample of citizens (96 people, 24 in each country and divided into 3 groups) who have been invited to participate in a mini-engagement process (STAVE tool).

The results show to what extent people are aware of the environmental discourse on sustainability and climate change, and to what extent it is integrated into their energy consumption habits. It is observed that, in most cases, citizens tend to present themselves as being competent in terms of sustainability, but at the same time they recognize the

limitations and constraints they face to do so. In all cases, the research method forces the participants to argue about the dissonance between what they believe they should do and what they actually do in such a way that highlights a series of obstacles and social mechanisms (such as economic constraints, family, status, enforcement of other actors, etc.) which are present in their everyday social environment. Knowledge of these mechanisms can be very useful when designing public policies for sustainability.

(Ana Prades López, Alex Boso, and Christian Oltra, from CIEMAT – Spain, are also co-authors of this paper).

### **Citizens' understanding of energy consumption in Romania: the case of domestic insulation**

*Marian Constantin (MR), Afrodita Marcu (Brunel University)*

■ Policy makers in many countries aim to encourage reductions of energy consumption among the citizens. However, how the public understand their energy-related behaviour and accept to change it is of crucial importance to the effectiveness of energy policies. The aim of this study was to explore citizens' understanding of their everyday energy consumption, and their motivations to change their energy-related practices. We explored this in the context of the National Thermal Rehabilitation Programme (NTRP) in Romania.

Tower blocks of flats in Romania are highly energy inefficient and their energy consumption accounts for about 36% of the total CO<sub>2</sub> emissions. A National Thermal Rehabilitation Programme (NTRP) was started in Romania in 2006 based on a financial scheme with equal contributions from the state, local authorities and owners. This was aimed at encouraging citizens to insulate their flats in tower blocks and reducing the energy consumption from 200 to a value lower than 100 kWh/m<sup>2</sup>/year. After 2010 due to the economic crisis all national and local contributions were cut despite a general consensus about the necessity to stimulate the insulation programme.

This paper investigates homeowners' perceptions and attitudes towards the insulation of their flats, and their reflections on their everyday practices in relation to energy use. The interest is to identify the paths of decision making at condominium level, the perceived barriers against insulation, and possible changes to promote the NTRP implementation.

The target population consists of homeowners living in tower block flats. The methodology is based on STAVE tool developed in FP7-PACHELBEL project, which consists of convened group discussions, diaries between sessions, and various group exercises. The

exploratory mode of STAVE was used. Three groups of citizens participated in three STAVE sessions with a clear defined protocol including focus group, oval-mapping, questionnaires, various stimulus materials, and group self-analysis.

The findings reflect the citizens' understanding of energy use and the extent to which policy discourses around sustainability can influence or not everyday practices, particularly in the Romanian socio-economic context. The findings also reflect the applicability of the STAVE tool in engaging citizens and in eliciting lay discourses around sustainable practices that can inform policy making in relation to energy reduction.

### **Issues and dilemmas of sustainable mobility from a citizen perspective**

*Ann Enander, Susanne Hede (Swedish National Defence College)*

■ Reducing emissions from fossil fuels is a major concern in developing sustainability. As an example, the climate-adaptation programme currently being implemented by the County Administrative Board of Värmland (Sweden) gives this issue a central role. From a policymaking perspective it is recognized that achieving results is greatly dependent on the transportation and mobility behaviours of the county citizens, particularly regarding shorter daily trips and leisure travel. At the same time there is also an awareness that policy measures in this area need to be based on deeper understanding of the motives and considerations underlying citizen behaviours. This policy issue was therefore chosen as a suitable focus for the PACHELBEL project in Sweden.

Everyday practices and discourses relating to transportation and mobility were examined in a series of 3 x 3 citizen group meetings in which the principles of the STAVE engagement process were applied and tested. The citizen groups comprised people with different backgrounds, life styles and daily habits. Transportation, and to some extent energy and private consumption, constituted main themes for these meetings. While citizens tended to agree in emphasizing the general importance of sustainable behaviours, data from these deliberations also identify a number of ways in which people can perceive dilemmas, conflicting values and difficult choices in relation to everyday mobility. For example sustainable behaviour can be viewed as conflicting with issues of safety, comfort or personal priorities. Furthermore, the findings highlight the significance attached to means of transportation in everyday life. The results also illustrate how different STAVE tools can serve to elicit different contributions in the citizen discourse.



# M11 Risk assessment

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*Chair: Dario Gregori (University of Padova)*

## **High performance computing and dietary risk assessment software**

*Cian O'Mahony (Creme Global)*

■ A probabilistic dietary exposure cloud computing system is presented. In order to accurately determine exposure to a food chemical(s) in a population, a complete diary of food consumption events needs to be combined with the appropriate chemical concentration data for each food. This concentration data may be uncertain, have known variability, be the output of a model, or be at a greatly aggregated level. In order to adequately determine the risk to consumers and assess all sources of variability, numerous Monte Carlo simulations are required. This requires high performance computing which is performed on the cloud. The software, data, and results are then presented to dietary experts via a straight-forward interface, allowing rapid risk assessments to be made. Sources of exposure that are considered include pesticides, food contact materials, additives, flavourings, contaminants, and food ingredients. These simulations can then be collated to determine susceptible subpopulations by determining the high consumers, the high percentiles, and the main drivers of exposure.

## **The difficult path to sustainable use of pesticides: risk assessment, rationality and contexts in European Commission's procedures.**

*François Allard (CELSA – Paris-Sorbonne University)*

■ The difficult path to sustainable use of pesticides: risk assessment, rationality and contexts in European Commission's procedures.

In this research project we choose to analyze risk assessment in the context of risk regulation, and therefore observed a European Commission's procedure on pesticides risk. We paid a particular attention to the transformations resulting from negotiations of the "risk" concept within the European public sphere.

This work tries to answer different issues related to risk: "pesticides" associated with "risk" as a social problem, the European Commission's attempts to promote a rational

public space of discussion and the question of contexts at the center of sustainable development policies regarding risk. The complex nature of the European legal environment leads us to adopt a techno-semiotic methodology, developed in Communication Studies, by analyzing the links between documents, media – especially digital media – texts and discourses.

We investigated the construction of pesticide risks as a social problem via the European Commission's procedure: it crystallizes the interests of many stakeholders on the question of pesticide risks, but also shows their implication in a larger debate about risk assessment and sustainable development. This work then helped us to understand how the European Commission managed to create a space for rationality, an entente between the stakeholders. This entente shoulders the possibility of a common world, of a common definition of risk.

Finally, the discursive strategies of the stakeholders are also focused on the re-contextualization of the concept of "risk". The challenge for those involved in the procedure is less to change the definition of "risk", than to raise the legislator awareness on the complexity of the problem in different environmental, societal and economic contexts. The goal of future risk researches can thus be to understand the "equipment" from the risk concept with these different contexts.

## **Comparing Bayesian network, artificial neural networks, classification trees and classical logistic models in quantitative risk assessment: an application to the European Registry of Foreign Body Injuries in Children**

*Dario Gregori (University of Padova), Paola Berchiulla (University of Torino), Daniele Chiffi (University of Padova), Arber Haxhiaj (Zeta Research Srl)*

■ Risk Assessment is the systematic study of decisions subject to uncertain consequences.

An increasing interest has been focused on modeling techniques like Bayesian Networks (BN) since their capability of (i) combining in the probabilistic framework different type of evidence including both expert judgments and objective data; (ii) overturn previous beliefs in the light of the new information being received, and (iii) making predictions even with incomplete data.

In this work we proposed a comparison among Bayesian networks (BNs) and other classical Quantitative Risk Assessment techniques such as neural networks, classification

trees and logistic regression. Hybrid approaches, which combine classification trees and BNs, are also considered. Among Bayesian Networks a clear distinction between purely data driven framework and BN which are built using expert knowledge is made.

The aim is directed to evaluate among this set of Quantitative Risk Assessment tools which best can be applied to assess the safety of children who are exposed to the risk of inhalation/insertion/aspiration of consumer products. The issue of preventing injuries in children is of paramount importance, and in particular in fields where product design is involved, a proper risk assessment can be of great usefulness. Data of the European Registry of Foreign Bodies Injuries are a valuable set of starting evidence to build up such risk models.

Results showed that Bayesian networks appeared to have both the ease of interpretability and accuracy in making classification, thus outperforming other methods.

## M12 Symposium: Eye tracking

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*Chair: Rebecca Hess, Vivianne H. M. Visschers (ETH Zurich)*

The aim of risk communication material is to help laypeople in their judgment and decision making. However, to make sure that laypeople profit from this information material, we first need to know what kind of information people pay attention to in their judgment and decision making processes and how different types of information affect their visual attention and, consequently, their decision-making behavior.

Visual attention measures, such as eye tracking and online attention tracking tools, are promising to examine risk-related decision making and to evaluate risk communication material because they provide researchers with directly measured data that are less prone to biases than self-report measures. Only recently, researchers started using them to investigate laypeople's attention for risk communication material, such as risk ladders and nutrition information on products. The results of the few studies on risk communication material and on nutrition information showed that visual attention measurement is indeed worthwhile. In this symposium, we therefore intend to give an overview of the latest studies on measuring visual attention in risk-related decision making. The four presentations will show how visual attention tools can be used for these purposes and how the

corresponding results can be used to optimize risk communication and decision-making. Moreover, the presenters discuss the added value of visual attention instruments and its pitfalls. The symposium ends with a debate about the implications of visual attention assessments for risk perception and risk communication research.

Presenters:

- Jacob Lund Orquin (Institute for Marketing and Organization, Aarhus University): Visual attention as a process trace for decision making
- Ryan Murphy, Michael Schulte (Decision Theory and Behavioral Game Theory, ETHZ): Flashlight (online attention tracking) and risky decision making
- Carmen Keller (Consumer Behavior, ETHZ): Eye tracking as a method for examining intuitive and deliberative decision making in low and high numerates
- Rebecca Hess (Consumer Behavior, ETHZ): Eye tracking of health information on products

### **Nutrition communication on food packages – does format matter?**

*Rebecca Hess, Michael Siegrist (ETH Zurich)*

■ Obesity is a major risk factor for many diseases in most modern Western societies. Therefore, nutrition communication concerning the composition of a healthy diet is a crucial aspect of contemporary health risk communication. One instrument for this communication consists of nutrition information formats on food packages that display information about the product's content of energy, sugar, fat, fatty acids and sodium. This information should help consumers buy products that, taken together, result in a healthy diet. Several such formats, such as nutrient tables, guideline daily values (GDA) or sign post labels are applied in different European countries. The present study examined whether these three formats result in similar attention processes concerning the displayed nutrient information or whether some nutrients are more visually salient in one of the formats. To answer this question, an eye tracker was used in a between-subjects design to measure the gaze directions and gaze durations of 98 participants. Gaze data were recorded while the participants were looking at nutrient information of five different food products displayed in one of the three formats with the task of deciding how healthy the product is. Visual attention paid to the five nutrients was operationalized as dwell times, number of glances and time of first glance on each nutrient. These variables were used to describe the overall visual attention on the three formats and to compare the three for-

mats. Preliminary results indicate that for some products, some of the single nutrients seemed to be slightly more salient when a GDA or a sign post format was used whereas in nutrient tables, the participants may have focused more on total energy values. Practical implications of these results for health risk communication will be given and the usefulness of eye tracking data for risk research within a nutritional context will be discussed.

### **Visual attention as a process trace for decision making**

*Jacob L. Orquin, Simone Mueller Loose (Aarhus University)*

■ One of the most fundamental assumptions in process tracing studies on decision making is that information acquisition reflects decision strategies. By examining patterns of information acquisition the researcher obtains insights on how the decision process unfolds and by classifying the information use decision strategies are identified. During the last decade there has been a surge of decision making studies using eye tracking as a process tracing method many of which have addressed the intimate relation between information acquisition, operationalized as visual attention, and decision making. In this period it has become apparent that allocation of visual attention under decision making is controlled simultaneously by bottom-up and top-down processes which essentially means that the very process of information acquisition is subject to seemingly arbitrary factors such as the saliency, size or position of the information stimulus. It has also been shown that not only do decision strategies affect allocation of visual attention, but attention also affects decision making by amplifying value signals. By complicating the assumed causal effect of decision strategies on information acquisition these studies cast doubt about whether decision strategies can actually be identified through information acquisition and thereby question the validity and usefulness of process tracing methods. To examine and if necessary revise the assumptions underlying process tracing methods all published studies on decision making using eye tracking as process tracing method were reviewed. With basis in the literature three revised assumptions are proposed: a) that stimulus characteristics can affect information acquisition through bottom-up processes such as visual saliency, size and position, b) that information acquisition can affect decision processes by controlling what information is available and also how the information is entered into the decision making process, and c) that decision processes can affect information acquisition by influencing top-down processes such as search goals.

### **Flashlight (online attention tracking) and risky decision making**

*Michael Schulte-Mecklenbeck, Ryan O. Murphy (ETH Zurich)*

■ We introduce and demonstrate Flashlight, an online research tool designed for conducting attention tracking experiments using any kind of visual stimuli. We discuss applications of this new tool, the types of data than can be gathered with Flashlight, and show how cognitive process models provide rich insights into the psychology of human decision making under risk.

The Flashlight tool shows a moveable clear area centered around the mouse cursor while leaving the rest of the stimulus blurred. The research participant moves the mouse pointer over the visual stimuli in order to see different parts of it clearly. This procedure mimics eye-tracking but does not require any special equipment beyond a standard internet connected PC. The tool provides insight into information acquisition with high precision, great flexibility regarding the stimuli used, and access to a wide population of participants available by running experiments over the Internet.

The analysis framework for attention tracking data is similar to established methods from eye tracking research. Within these contexts researchers can determine: What information people are attending to; How long they attend to particular information; What order of information people attend to. More complex analyzes are possible by modeling the transitions between areas of attention and the resulting patterns of changes in attention.

Finally we will show results from an experiment on risky decision making where participants make choices between risky gambles. Flashlight is open source and can be downloaded, modified and used freely at: [http://vlab.ethz.ch/vLab\\_Decision\\_Theory\\_and\\_Behavioral\\_Game\\_Theory/Flashlight.html](http://vlab.ethz.ch/vLab_Decision_Theory_and_Behavioral_Game_Theory/Flashlight.html)

### **Eye tracking as a method for examining intuitive and deliberative decision making in low and high numerates**

*Carmen Keller, Rebecca Hess, and Michael Siegrist (ETH Zurich)*

■ Recent research has shown that eye tracking offers a promising means of examining processes underlying intuitive and deliberative decision-making (Schulte-Mecklenbeck et al., 2011). The present study combines two research directions that have been followed separately in the past: theoretical and empirical research on numeracy (Lipkus & Peters, 2009; Reyna et al., 2009) and theoretical and empirical research into processes underlying

decision-making using process data (e. g. Horstmann et al., 2009). Studies carried out in the latter area have used eye tracking to delineate information processing in decision-making. In the present study, a random sample of participants drawn from the general population (N = 160) were presented with a scenario on a computer screen which described a person who received her personalized test result indicating her probability of having colon cancer (17%). A combined risk communication format was used, which presented the risk information in terms of a percentage, alongside a pictograph on the same screen. Participants had to indicate the affect evoked by the presented risk information on a scale ranging from 1 (negative) to 9 (positive), which was presented on the same screen, below the aforementioned pictograph and the percentage. A 2 (decision mode: deliberative/intuitive) × 2 (numeracy: high/low) design was used. Eye movements were tracked while decision-making was carried out. In line with the integrated process perspective decision model (Gloeckner & Betsch, 2008), high and low numerates showed the same level of information processing in both decision modes. However, in the intuitive decision mode, an analysis of various eye-tracker parameters revealed that high numerates seemed to process the percentage before the pictograph, while low numerates processed the pictograph before the percentage. No differences were found in the deliberative decision mode. The theoretical and methodological implications will be discussed.

## M13 Symposium: Associative processes in risk perception and communication: the case of food risks and benefits

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*Chair: Afrodita Marcu, Julie Barnett (Brunel University)*

Research within the social amplification of risk framework has shown that communicated risks often become socially amplified, generating stigma-related effects to other products, places, or technologies (e.g. Kasperson et al., 1988; Gregory, Flynn, & Slovic, 1995). However, little light has been shed on how or why more or less (un)associated products get affected, or how an object can be made resistant to particular associations. The focus of this symposium is on research that aims to close this evidence gap by exploring how

categories influence associations between products, what heuristic strategies are used in making associations, and how affective tags can protect objects from risk associations. We focus on communicated food risks and benefits in a number of European countries, as part of the ongoing FoodRisC project. The first paper, Investigating European consumers' reactions to the communication of food risk uncertainty (Regan & Wall), describes how consumers react to risk and benefit information at different stages of a food crisis and examines the role of uncertainty source (e.g. social vs. scientific) as predictor of risk and benefits perceptions in relation to red meat. The second contribution, The role of uncertainty and food category salience on the risk perception contamination of food products (Gaspar et al.), examines the effects of food category salience and uncertainty on perceptions of risk contamination. The third paper, The impact of episodic and thematic framing on food risk associations under conditions of uncertainty (Marcu & Barnett), explores whether episodic or thematic frames prompt representativeness heuristics, and how these, in turn, may lead to risk associations between products. The final contribution, Can previously made associations prevent social amplification in risk messages? (Rutsaert & Verbeke), examines how positive tags like 'organic' can protect products from being associated with risk, with a focus on functional foods.

### **The role of uncertainty and food category salience on the risk perception contamination of food products**

Rui Gaspar, João Carvalho, Beate Seibt, Luisa Lima (Instituto Universitário de Lisboa (ISCTE-IUL), Centro de Investigação e Intervenção Social (CIS-IUL))

■ The role of prior knowledge and contextually available information on risk perception and communication has been studied by some researchers (for example within the mental models approach, e.g. Morgan, Fischhoff, Bostrom & Atman, 2002). However, most of this research has concentrated on describing associations between risks, and less on explaining the conditions under which these associations occur. Recently some empirical studies have tried to specify the conditions under which people use prior knowledge and, particularly, associations, when evaluating risk (Connor & Siegrist, 2011; Visschers, Meertens, Paschier & Vries, 2007). Accordingly, affect has been shown as important but little attention has been given to other variables, such as uncertainty and category salience, in studying associations.

Therefore, we aim to understand the role of these variables to answer the question: can the emergence of a given risk for a certain food imply the risk perception “contamination” of other foods associated with the former? This experiment includes 100 Portuguese participants. The first manipulation uses a between-participants priming task in which one of two different food categories are made salient (X or Y). Subsequently, participants are presented with a scenario in which risk associated with consuming a target food product is present and certainty vs. uncertainty vs. absence of certainty is communicated (between-participants). The final task measures risk perception of different types of food, within the salient (X or Y) or unrelated food categories (Z, ...). It is expected that perceived risk associated with the target product contaminates perceptions of the products within the salient but not within the unrelated (Z, ...) or non-salient category (X or Y depending on the condition). Additionally, we want to explore if uncertainty facilitates contamination when the related category is salient. Implications of these results for risk communication will be addressed.

#### **Investigating European consumers’ reactions to the communication of food risk uncertainty**

*Aine Regan, Patrick Wall (University College Dublin)*

■ It is important risk communicators understand how the public respond to the open and transparent communication of uncertainty relating to food risks and benefits. Van Kleef and colleagues (2007) suggested that in situations of great uncertainty individuals may use social trust (Siegrist et al., 2000) as a heuristic for dealing with the information. One explanation for this is that they psychologically outsource the responsibility of dealing with this uncertain information so that they can avoid the cognitive dissonance created by such information. There has been no research to understand how this phenomenon may work when the public are responding to uncertainty in times of a food crisis or whether different types of uncertainty may elicit different effects. Conflicting information or views from experts appear to be received more negatively than other types of uncertainty by the public (Breakwell & Barnett, 2003; Smithson, 1999). It may be that consumers differentially use social trust as a heuristic in response to different uncertainty types. Transparency during a food crisis is critical. The communication of uncertainty in such contexts may serve to enhance credibility of those communicating. However, this may differ depending on the type of uncertainty communicated; consumers may be more

accepting of epistemic uncertainty (as a ‘natural’ by-product of the scientific process) compared to conflicting views (which may lead to the perception of vested interests). The current study used a factorial experimental design which presented respondents across multiple European countries with a food risk and benefit scenario. The manipulations included systematically varying the levels of two factors of interest (uncertainty type and crisis context) to investigate how they impacted participants’ dependence on authorities and information seeking. Results will be discussed in relation to individual and culture differences and subsequent implications for risk communication.

#### **The impact of episodic and thematic framing on food risk associations under conditions of uncertainty**

*Afrodita Marcu, Julie Barnett (Brunel University)*

■ Studies within the social amplification of risk framework have often highlighted that socially amplified risks can generate stigma-related effects to entities such as places, technologies, or products (e.g. Gregory, Flynn, & Slovic, 1995; Kasperson, Jhaveri, & Kasperson, 2001). While such research acknowledges that risk amplification involves heuristic pathways (e.g. Kasperson et al., 1988), little research has focused on what specific heuristic strategies underpin these ripple effects and the spreading of stigma. In this vignette experiment conducted with one hundred participants in the UK we examine how the communication of food risks in terms episodic vs. thematic frames impacts the lay perceptions of food risks and the associations of one stigmatized food product with another. Framing, i.e. the specific concepts and terms used to present decision options, has been found to influence judgment and choice (e.g. Iyengar, 1990; Aaroe, 2011). Thematic frames provide general information about an issue, whereas episodic frames provide case studies of the issue. Given the ability of episodic framing to focus on exemplars, and of thematic framing, on categories, we examine whether different frames prompt different heuristic strategies and different judgments of typicality. Furthermore, we examine whether these judgments underpin the formation of associations between stigmatized food products and others. This study draws on the representativeness heuristic and the availability heuristic (Tversky & Kahneman, 1974), where the representative heuristic involves judgements of typicality, while the availability heuristic refers to the ease with which examples can come to mind. The results of this study are expected to contribute to the SARF research

paradigm, as well as to research on heuristics and lay reasoning processes. The implications of the results for risk communication practices will be discussed.

### **Can previously made associations prevent social amplification in risk messages?**

*Pieter Rutsaert, Wim Verbeke (Ghent University)*

■ Social amplification forms a significant threat in risk and benefit communication (Kasperson et al., 1988). Ripple effects can occur among different aspects of the same affected product, but can also occur in relation to other products that have become associated with the initially affected product. The EHEC crisis in Germany in 2011 illustrated that ripple effects can spread to other products, countries and industries. But can a product be made resistant against particular negative associations? During the German dioxin crisis in 2011, which occurred a few months before the EHEC crisis, the demand for “organic” products increased. Arguably, this shows that the tag “organic”, reassured consumers of ‘naturalness’ and ‘purity’ (Rozin, 2005), and was capable of protecting eggs from getting associated with dioxin. This study will test how positive tags can protect products from stigmatization. A second goal is to see how important the strength of the connection between the positive tag and the associated product is and which role past associations play (Smith, 1998).

These research assumptions will be tested in the context of functional foods, in a vignette experiment with 100 Belgian participants, with a focus on positive tags like ‘organic’. Existing literature shows that acceptance of functional foods depends mainly on the base product. Comparisons between yoghurt and soup as carriers show higher acceptance and willingness to try for yoghurt-based than for soup-based products. It has been suggested that the existing marketing and commercials are a major driver for this difference, which means more past associations are made between yoghurt and the idea that this product has health benefits (Siegrist et al., 2008). The aim is to see if this link with a health benefit can protect the base products from a negative message and to test the level of protection for two products with a different history to the connected product.

## **M14 H1N1: risk perception and communication**

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*Chair: Britt-Marie Drottz-Sjöberg (Norwegian University of Science and Technology)*

### **H1N1 risk communication for pregnant women and seniors**

*Cindy Jardine, Leah Lechelt, Tania Bubela (University of Alberta)*

■ The 2009–10 H1N1 outbreak and subsequent vaccination program presented many challenges for public health agencies in Canada. Risk communication is a critical strategy for providing ongoing information during a pandemic and for promoting informed decisions on appropriate health protection behaviours. But did public health agency communications achieve these goals, especially with vulnerable populations? Between October 2010 and April 2011, 17 focus group sessions were held across the province of Alberta to ascertain the experiences of two vulnerable populations: seniors (65 years and older), and women who were pregnant or breastfeeding during the outbreak. Participants were asked about their knowledge of H1N1, their information sources, feelings of risk, vaccination information and decisions, and personal experiences with the disease and vaccinations. Although most people were initially only casually interested in the possibility of a flu pandemic, concern increased with reports of serious illness and deaths of younger Canadians. Traditional media coverage was the dominant source of information for both groups, with everyone commenting on the degree of “media hype”. Although most pregnant women also used the Internet (including email and social media), this source was used by very few seniors. Family and friends (particularly those working in health care fields) were cited most frequently as trusted sources of information. Most seniors were vaccinated, treating this decision as routine. However, pregnant women had more difficulty reaching the “right” decision, with concerns about vaccine safety. In general, the results indicated that H1N1 risk communication was not completely effective for these populations, with much confusion about vulnerability, vaccine availability and vaccine safety.



## **Canadian local Public Health unit responses to pandemic H1N1: risk communication challenges**

*S. Michelle Driedger (University of Manitoba), Margaret Fast (National Collaborating Centres for Infectious Disease)*

■ Risk communication during a pandemic can be particularly complex and difficult when there are multiple levels of government responsibility. In Canada, broad principles to protect the health of Canadians are the responsibility of the federal government, whereas it is up to the provinces to determine how best to meet those guiding principles. During pandemic H1N1, while the Public Health Agency of Canada was the lead agency responsible for setting priorities for communications messaging and vaccine roll out, actions were often negotiated in collaboration with the provinces. The provinces then devolved these responsibilities to the local/regional/municipal level for service delivery. This presentation will highlight the challenges that these public health units faced in managing the response when high level messaging did not always fit with local context. Key informant interviews with 30 Medical Officers of Health from seven provinces were conducted between June and August 2011. Participants commented that streamlined communications using diverse methods to disseminate information to both health care workers and the general public was one of the system's greatest strengths. However, confusion at the local level was caused by inconsistent messaging and guidelines from provincial and federal systems that made communication with the general public about immunizing priority groups and administering antivirals difficult. These challenges were addressed through a variety of strategies: the relationships that local regions had developed with mainstream media outlets as well as existing outreach programs targeting marginalized populations were used to successfully inform and immunize targeted groups in core areas.

## **"It is just like flu" – H1N1 vaccination uptake and the curse of habitual risk perception and behavior pattern**

*Franziska Boerner (University of Alberta/University of Manitoba), Laura Winton (University of Alberta), Jennifer Keelan (University of Toronto), S. Michelle Driedger (University of Manitoba), Cindy Jardine (University of Alberta)*

■ Two critical components in any response to a pandemic are the rapid development of a vaccine and effective risk communication. Despite the rollout of a publicly funded H1N1

vaccine program across the country, less than half (40%) of all Canadians were vaccinated during the 2009–10 pandemic. While the low vaccine uptake rate in Canada was still higher than approximate rates in the U.S. (20%), Australia (30%), Germany (5%), it can be contrasted with immunization rates against other infectious diseases like measles (given in childhood), which are significantly higher (94%). Using a combination of survey and focus group data, this study examined vaccinating behaviours, the impact of public health messaging, and the public's attitudes towards H1N1 in three Canadian provinces. Drawing on vaccine risk communication literature, we devised a framework to analyze factors related to vaccine uptake and vaccine refusal. Our research suggests that the most predictive factors for H1N1 vaccine uptake were a prior history of vaccinating against seasonal influenza and peoples' risk perception towards seasonal influenza. Other factors included access issues, vaccine safety concerns and issue-fatigue from constant emotive reporting on the evolution of the pandemic. Though we did identify critical gaps in the public's understanding of influenza infections, and misinformation about vaccination effectiveness and safety, these factors did not generally drive participant decisions to vaccinate. We conclude with a series of recommendations to increase the effectiveness of vaccine-related risk communication including an increased focus on health literacy around vaccine and influenza information in pandemic communication strategies, recognizing the challenges for pandemic vaccination against a backdrop of annual vaccination campaigns.

## **H1N1, Science and Society**

*Britt-Marie Drottz-Sjöberg (Norwegian University of Science and Technology), Yves Charpak (Member of the board of the French Public Health Society)*

■ In 2009 the world experienced yet another pandemic health challenge, i.e., the quick spread of the H1N1 influenza virus. In the first months of 2009, deaths classified as influenza deaths had occurred in Mexico, and from April 2009 the disease started to spread, in the USA in particular. Previous large scale pandemics, such as SARS and the avian flu, had sensitized health authorities to the risks and potentially huge impacts of new viruses. Most countries had preparedness plans for influenza, as recommended by the World Health Organisation (WHO) and 'prescribed' in the renewed International Health Regulations. Pandemic management was set up at various governance levels, from the WHO to municipalities. In mid 2010, the European Commission's Directorate "Science, Economy and Society" decided to set up an Expert Group on "Science, H1N1 and Society" in order to

clarify the Science in Society (SiS) related research questions raised by the H1N1 pandemic and associated crisis management. Questions that seemed to have caused much attention included if the pandemic had been managed in an optimal way by health authorities and if the scientific advice underpinning the decisions was adequate, in particular regarding proper assessment of the pandemic risks and vaccination strategies. The Expert Group's report was made available after a presentation of the results to a Programme Committee meeting at the European Commission in September 2011. The report reflected views from various types of experts and stakeholders. It underlined the fundamental necessity of understanding the virus and the need for including broad scientific expertise into decision processes. The role of risk communication was highlighted and discussed in relation to especially trust and social media influences. Ethical aspects, including risk management strategies and individual choice in the situation of a pandemic, were of central importance in the work. So were also perceptions of risk, reflected in decision processes, public and media reactions related to vaccination, and the cultural variation of trust in various information sources. The report generally underlines the necessity of quick knowledge acquisition, broad involvement of relevant stakeholder groups and of many scientific disciplines in decision making processes also during severe crises situations.

## M15 Symposium: Carbon Capture and Storage

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*Chair: Selma L'Orange Seigo (ETH Zurich)*

Carbon Capture and Storage (CCS) is a promising new technology to help combat climate change. According to scenarios by the International Energy Agency (IEA), it could account for up to 19% of the overall emission reductions in 2050. Whether CCS will actually be deployed on a large scale, depends both on technological development and social context. Public opinion plays an increasing role in the application of new technologies, and CCS is no exception. It is therefore important to understand what shapes public perception and how the risks of CCS can be communicated to enable informed decisions among laypeople. In this symposium, we will look at all aspects of risk communication about CCS. What insights from other technologies can be applied to CCS? What is unique to CCS in terms of risk communication, and how can these challenges be tackled? How can

the entire spectrum of risk communication be addressed, from educating the general public to project-specific community engagement? Such and other questions will be discussed by leading researchers in the field.

### **Risk perceptions and communication of CO<sub>2</sub> Capture and Storage (CCS)**

*Diana Schumann (Forschungszentrum Juelich, IEK-STE)*

■ The future large-scale demonstration and application of CO<sub>2</sub> capture and storage (CCS) will depend on its public acceptance. As it is well known that the acceptance of technologies is largely influenced by risk perceptions, it is important to understand what factors shape laypersons' perceptions of the risks associated with CCS technologies. Information on CCS can then be communicated in a manner that will allow the public to perform a well-informed and well-considered assessment of these risks.

This presentation will address the similarities and differences in risk perceptions, the determinants of risk perceptions as well as the influence of risk perceptions on the direction and stability of initial attitudes towards CCS using the example of Germany. The methods applied to Germany were descriptive analyses, regression analyses and structural equation modelling analyses (SEM).

Firstly, the presentation will illustrate that risk perceptions of CCS differ with the characteristics of individuals (gender, education) and of the process steps (capture, transport, storage) as well as with different regions (Rheinschiene, Schleswig-Holstein, rest of Germany). Secondly, it will show that the risk perceptions of CCS are largely determined by the perceptions of the technologies' benefits. Thirdly, it will explain that risk perceptions are not only a predictor of the direction but also of the stability of initial attitudes regarding CCS. Drawing on the results presented, the presentation will close with conclusions on the communication of CCS.

### **Public perception of CCS in Switzerland and Canada: a comparison**

*Selma L'Orange Seigo (ETH Zurich), Joseph Arvai (University of Calgary), Simone Dohle (ETH Zurich), Michael Siegrist (ETH Zurich)*

■ Public acceptance is more and more regarded as one of the keys to a successful implementation of Carbon Capture and Storage (CCS). Studies assessing public perception are faced with the problem that awareness of CCS is low and the issue often rather hypothetical for participants. It is therefore difficult to assess how generalizable results are. In the



current study, a Swiss survey was replicated in three different provinces of Canada, which allows some cross-cultural comparison. It also allows for a comparison of perception across regions with different levels of CCS implementation. In Switzerland, there are no CCS projects so far, in Canada there are provinces with operating CCS projects (Saskatchewan), with a number of planned projects (Alberta) and with no CCS (British Columbia). The original Swiss survey looked at the influence of typical lay concepts and factual knowledge about CCS on benefit and risk perception. In the Canada survey, some additional items were included, measuring trust and more detailed knowledge about climate change. The survey was administered via an internet panel to a representative sample of 1,500 participants (500 per province). Results offer a tentative insight into cross-cultural comparability of CCS acceptance data and the question whether the concepts that can predict acceptance are the same at different implementation stages.

#### **A comparison of mental risk concepts on carbon dioxide capture and storage (CCS) and deep geothermal energy (DGE)**

*Lasse Wallquist, Matthias Holenstein (Risk Dialogue Foundation)*

■ The deployment of low carbon energy technologies is considerably challenged by local public protests. New energy technologies such as carbon dioxide capture and storage (CCS) or deep geothermal energy (DGE) that interfere with the natural deep subsurface are in particular affected by elevated levels of public risk perception. We examined influential factors for increased risk perceptions in two case studies with local residents living near potential geological targets for DGE in Germany and Switzerland. In-depth interviews with laypeople were conducted to study the mental concepts that determine risk perception of DGE. We compared the risk perception characteristics of DGE with existing literature on mental concepts of CCS, and identified similarities and differences between the two technologies. Results indicate that mental concepts about artificial pressure changes in the deep subsurface caused by EGS or CCS operations are leading in both cases to an increased risk perception from movements of the ground and induced seismicity. Both technologies are perceived to tamper with the subsurface and trigger a primal fear among some laypeople. In the case of CCS, the pressure concept also underlies risk perception from leakage of CO<sub>2</sub>. For DGE the misconception of a cooling-down of the earth's core seems furthermore relevant for increased risk perception. Awareness of seismic events induced at earlier geothermal projects heavily amplifies risk perception of the local public

near some projected locations. This gives an indication on how heavily public attitudes about CCS would be damaged in case of an incident at a CO<sub>2</sub> storage location. Regarding perceived sustainability of the two technologies, the results show a more positive evaluation of DGE than of CCS. CCS is considered as a band-aid for climate change whereas DGE is seen as a contribution to a sustainable energy economy. We conclude that differences in public acceptability of the two technologies are in a large part due to socioeconomic aspects, as both DGE and CCS are perceived as (high)-risk technologies from a technical perspective, but from a socioeconomic perspective, only CCS is perceived as such.

## M16 Risk Governance

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*Chair: Ibo van de Poel (TU Delft)*

#### **Balancing act. On the sharing of responsibility for physical safety**

*Karin Ammerlaan (Scientific Council for Government Policy), Marjolein van Asselt (WRR)*

■ Care for physical safety is not only a core task, the government also has a direct (as a potential victim) and indirect (as a safety net and lifebelt) interest in a high level of physical safety. Infringements of physical safety (disasters and incidents) have a huge impact on society. How can the government fulfill its responsibility to ensure physical safety on the basis of legal obligations and the need for collective arrangements, and at the same time ensure that individuals and businesses also take their own responsibility? We have outlined a number of options that can contribute to a balanced division of responsibilities.

Politicians often feel the pressure to (over)react after disasters or incidents. In the Dutch discourse on government responsibility, the concern is focused on acting after accidents. However, more strategically the emphasis should be on preventing or preparing for accidents, hence on dealing with risk, uncertainty and the possibility of damage.

One important option is thinking of 'arrangements for damage' (compensation mechanisms) as an important starting point in reviewing the existing division of responsibilities. Such provisions should serve two purposes: covering damage and providing incentives to avoid incidents, minimize damage, control risks and address uncertainty proactively. We believe that businesses and citizens must also bear responsibility for this, for example by

insuring themselves better. Thus, it is necessary that the government takes on a systemic responsibility and assigns shared responsibility to individuals, businesses and the government for preventing, limiting and covering damage. This is a demanding challenge, but not a mission impossible.

### **Risk regulation in Europeanising Eastern Europe: cases of Estonia and Lithuania**

*Kati Orru (Estonian University of Life Sciences/King's College London)*

■ The research raised the issue of applying standard approaches and fixed risk mitigation measures in the variable contexts of Europe. It addressed the reasons for different regulatory strategies in new Member States when adapting to the EU Drinking Water Directive that was initially designed to meet the needs of larger conurbations.

This comparative, semi-qualitative study of two risk regulation regimes (Hood et al., 2001) provided the opportunity to clarify why the Lithuanian regulators have gone beyond the strict but limited requirements of the EU DWD, whereas the Estonian system diligently follows the EU requirements.

The joint legacies of Soviet state-dominated water regulation yet differing development trajectories following the rebuilding of their statehood, as well as country-specific risk issues and stakeholder configurations, have determined the responses to the EU regulatory requirements in Estonia and Lithuania. In both countries, the adoption of the EU DWD was determined by the political and regulatory elites. In Lithuania, the well-coordinated local safety-control system combined with the traditions of state safety provisions along with generally higher alert levels, have led the Lithuanian government to introduce extra safety measures. Nevertheless, the Estonian *laissez faire* type of regime offers more protection due to the effective regional coordination of the EU support fund allocations for water systems upgrading in Estonia.

The regime perspective has shown how the regulatory elite-driven change in goals and measures of risk regulation may be supported by appropriate control and enforcement practices only after a time lag. Orientation to compliance with the EU safety goals and control requirements may lead to inappropriate allocation of regulatory resources and may leave country specific risk issues unaddressed in the national and EU policies.

### **Risk governance of slow-developing catastrophic risks**

*Marie-Valentine Florin (International Risk Governance Council), Len Fisher (University of Bristol)*

■ There are many slow-developing risks that are currently putting the planet or society under pressure and may cause catastrophes. Systems are moving closer to catastrophic change as resilience decreases and eventually tipping points are reached and passed. These risks affect both ecological and socio-economic systems and many arise from secondary consequences of human activities that were predominantly developed to benefit humanity. Biodiversity loss, ocean acidification, sea-level rise, and desertification are all examples of such slow-developing risks in the environmental field. Population aging, rise of health care costs and fiscal debts are example in the societal and economic fields. Because these risks emerge from small incremental changes that take place over a long period of time, they often go unnoticed or are ignored because they are difficult to deal with under existing governance structures.

Improving the governance of these risks in order to avoid approaching dangerous “catastrophes” faces four major challenges: 1) understanding the scientific knowledge about them and what science can do, 2) understanding the context in which decisions are or need to be made, 3) cultivating effective bi-directional communication and understanding between scientists and policymakers and, 4) overcoming the strong bias towards inaction.

Science can provide tools to better understand complex adaptive systems and help anticipate critical transitions, but there is too frequently a disconnect between scientists and policymakers, where scientists do not understand what policymakers need and policymakers do not understand what scientists can offer. Policymakers are rarely rewarded or even recognised for making decisions whose benefits only become noticeable far into the future and are difficult to measure.

This presentation will explore the above obstacles to effective management of slow-developing risks with potentially catastrophic outcome, and suggest what can be done to overcome them. Content will be based on the outcome of an expert workshop on this topic, organised by IRGC in August 2011, with experts from science and policy.

## New technologies as social experiments

*Ibo van de Poel (TU Delft)*

■ Technologies like biotechnology, nanotechnology and nuclear energy technology not only bring large social benefits but also introduce potentially catastrophic hazards. Many of the conventional approaches to risk governance are not directly applicable to these fields due to high levels of uncertainty and ignorance about potential hazards. To overcome this problem, I propose to conceptualize technology as a form of social experimentation and to investigate the conditions under which such social experiments are morally acceptable. In this perspective, introduction of technology into society is not seen as a one-off decision but rather as an ongoing social experiment. On the basis of a conceptualization of technology as social experimentation, conditions for responsible experimentation will be proposed.

In my contribution I will give illustrations of how developments in three technical domains – nuclear energy technology, biotechnology and nanotechnology – may be insightfully conceived as social experiments. I will then investigate possible conditions for responsible social experimentation building on three sources: the ethics of experimenting with human subjects, the ethics of technological risks and insights about the management of technology in society.

I will discuss the implications of the proposed perspective for risk assessment, risk governance and regulation and for social discussions about the acceptability of risks.

## M17 Managing natural hazards

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*Chair: Elisabeth Krausmann (European Commission, Joint Research Centre)*

### Risk-responsible institutions as agents, conveyors and recipients of vulnerability

*Kalliopi Sapountzaki (Harokopio University of Athens)*

■ The present work focuses on institutions responsible for risks generated by natural hazards. In cases of natural hazard mismanagement these institutions are usually blamed and respective weaknesses are attributed to their vulnerability. It has been suggested that vulnerability of an institutional system signifies its failures to accomplish its competences,

i.e. planning and implementation of risk mitigation strategies. A wide range of examples from the literature indicate that institutional vulnerability may transform into social, economic etc and be transferred to selective agents. Sapountzaki (2011) alleged that institutions function as “Vulnerability Actors” utilizing own resilience to “reset” own and others’ vulnerability balance in time, space and among the several vulnerability facets (social, institutional, ecological etc) versus various hazards also. It follows from this theoretical model that institutions may:

- be vulnerable and rebalance (internally) their vulnerability;
- transfer vulnerability to social and other agents;
- receive vulnerability from above agents;
- transfer to or receive vulnerability from other interconnected institutions;
- counterbalance their own with vulnerability of interconnected institutions.

Vulnerability status of a risk managing institutional system and each of its component institutions depends on (a) its structure (linkages and hierarchies among the components), (b) the accessible resources and their distribution within the system and (c) the vulnerability dynamics of the social and other agents under its competence. The present work offers a group of matrices interrelating parameters determinant of above (a), (b), (c) conditions with the potentiality for activation of specific dynamics of vulnerability resetting. These matrices serve as a guide for judging institutional vulnerability.

### Risk analysis as a tool to support emergency action planning against flood risk

*Jesica T. Castillo-Rodríguez (Polytechnic University of Valencia (Spain)), Ignacio Escudero-Bueno (Polytechnic University of Valencia (Spain)), Sara Perales-Momparler (PMEnginyeria), Armando Serrano-Lombillo (iPresas Risk Analysis), Luis Altarejos-García (Polytechnic University of Valencia (Spain) & iPresas Risk Analysis)*

■ A new perspective towards higher standards for safety and security have risen in the last years and decision-makers are asked to develop and use new tools to evaluate the effect of measures and take actions to reduce the potential consequences of natural or man-made hazards.

After the EU floods directive (2007/60/EC), flood risk reduction has become a top priority in many countries. In such a changing and demanding environment, flood risk analyses arise as comprehensive and robust approaches to determine the nature and extent of risk

by analyzing potential flood hazards and evaluating existing conditions of vulnerability. Therefore, new tools have emerged recently to assess the existent risk.

This paper summarizes the SUFRI Methodology for pluvial and river flooding risk assessment in urban areas to inform decision-making which has been developed within the SUFRI project (2<sup>nd</sup> ERA-Net CRUE Funding Initiative, 2009-2011). This methodology proposes the use of risk models and F-N graphs to obtain quantitative societal and economic flood risk. Different flood scenarios can be analyzed to incorporate available information on their probability of occurrence and potential consequences into risk models. F-N curves are the basis to illustrate risk quantifications and the effect of different measures on flood risk reduction.

This paper aims to describe how the use of risk models and the application of risk analysis techniques offers great added value to flood risk assessment methodologies, providing straightforward but complete outcomes that can be used by authorities, local entities and stakeholders to improve flood emergency management strategies and to prioritize flood risk reduction measures. As an example, the analysis of a town located in the eastern region of Spain, yearly affected by pluvial flooding, is presented. Results and conclusions from risk analysis have been applied to develop the Municipal Action Plan against Flood Risk.

### **Cargo – dead or alive. Comparison of risk-based decision-making in operations at different vessels in the Norwegian aquaculture industry**

*Kristine Størkersen (NTNU Social Research)*

■ Aquaculture is one of the utter most accident exposed industries in the countries where it is practiced.

An earlier exploration of the fish farm decision-making showed that decision-makers neglected their personnel safety on behalf of product safety (Størkersen 2011). The fish are first priority, because it can lead to economical and environmental disaster if they die or escape. Fishfarmers cannot stop repairing the net because the weather is bad and there is risk of personal harm. This indicates that there is need for untraditional safety measures when dealing with a biological product.

In this paper I go deeper into the relationship between personnel safety and product safety by studying two types of cargo vessels in the aquaculture industry: Wellboats and

fodder boats. How do the cargo's characteristics influence the risk-related decision-making?

This will be explored by material from interviews of 65 persons on nine fish farms, three well boats, and three fodder boats. The boat types are selected because one deals with a live product (salmon) and the other a 'dead' product (fodder pellets). Both well boats and fodder boats are a part of the aquaculture industry and therefore have similar framework conditions. The presentation will investigate the risk-based decision-making during loading and discharging of fodder between fodder boat and quay/raft, and loading and discharging of salmon between well boat and net cage.

Preliminary results indicate that the cargo is an essential decision-making factor, especially for crews with live cargo. The well boat crew sets the fish first, while the fodder boat crew do not have to treat their cargo the same way.

Still, their decision-making is influenced by the framework conditions made by other levels of the organisation and the society. When the accident rate is as high as in the aquaculture industry, it shows that the other levels of decision-makers have not tried every possible measure to increase safety.

### **The impact of space weather on critical infrastructures – how real is the risk?**

*Elisabeth Krausmann, Georgios Giannopoulos (European Commission, Joint Research Centre)*

■ Many modern technological infrastructures are known to be vulnerable to the effects of natural hazards. Extreme space weather caused by solar activity, such as geomagnetic storms or radio bursts, has so far been largely neglected as trigger for the disruption of critical-infrastructure services. However, there is evidence that space weather can have serious impacts on space- and ground-based critical infrastructures and services, such as electrical power grids, telecommunication, navigation, transport or banking. A recent study showed that the impact of a severe geomagnetic storm on the US power grid could result in severe damage to the grid infrastructure which could have a ripple effect on other services reliant on electrical power, such as communication, potable water distribution, refrigeration of food and medication, etc. The study estimates the societal and economic costs of this superstorm scenario to be of the order of 1–2 trillion \$US in the first year alone, with recovery times of 4–10 years depending on the damage severity. Moreover, the performance of new technologies (e.g. wireless systems), developed in the last

decade during a period of solar quietude, is uncertain under extreme space-weather conditions.

In order to guarantee the smooth functioning of society it is therefore important to fully recognise the vulnerabilities of critical infrastructures with respect to extreme space-weather events. This includes an understanding of the risk to a specific infrastructure itself and the service it provides, as well as the risk of affecting other infrastructures through cascading effects. As a first step towards achieving this goal this work analyses data sets on space-weather triggered incidents collected during this study to qualitatively assess the relevance of the hazard with respect to selected types of critical infrastructures. It also highlights the mean weaknesses and identifies their possible consequences on the infrastructure or service performance.

## M18 Decision making in a complex world: how people cope with synergistic risks and ambiguities

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*Chair: Ian Dawson (University of Surrey)*

### **Are conditional contribution profiles determined by context and framing: the case of rural villagers in Benin**

*Jonathan Gheyssens (ETH Zurich)*

■ We use a modified version of the linear public good game in rural villages of Benin to test different assumptions related to conditional cooperation profiles and their dynamics.

We perform a comparative exercise to assess if the conditional profiles and their respective shares are similar to what was observed in comparable experiments played in developed countries and find that both the nature and the distribution of the profiles are significantly different.

We then introduce risk and loss framing to determine the robustness of the conditional profile distribution to changes in the structure of the games. We find a strong and signifi-

cant positive impact for loss framing and a negative but weaker impact from the introduction of risk on the conditional profiles.

Finally, we combine profiles and unconditional contributions and notice a significant link between the two. It may imply that villagers with a similar profile tend to also contribute similarly.

### **Investigating risk reduction mechanisms in outcome ambiguity: experimental evidence**

*Ozlem Ozdemir Yilmaz (Middle East Technical University, Ankara, Turkey), Cengiz Yilmaz (Middle East Technical University)*

■ This study examines individual valuations of two risk reduction mechanisms: self-insurance and self-protection in risky and ambiguous situations. For self-insurance, human precautionary actions can influence the size of the loss, whereas for self-protection, they reduce the probability of the occurrence of an event. Both self-insurance and self-protection can be equally desirable according to expected utility theory, however, literature has shown that differences may exist between their impacts on individual responses to risk. Although there are many theoretical works about this issue, there are only two experimental studies with contradictory results. The present study retests the difference between valuations of these mechanisms. With respect to ambiguity, probabilistic ambiguity is defined as the uncertain situation where probability of occurrence of an event is unknown, and outcome ambiguity is defined as the one where the magnitude of the loss/gain is unknown. The current study is the first attempt that detects how individuals value self-protection and self-insurance when loss size is ambiguous.

In our experiment we ask individuals to indicate their willingness-to-pay to reduce the probability of loss and the magnitude of loss separately in risky situations (with known probability and known loss amount) and in ambiguous situations (with known probability and unknown loss amount) with the same expected loss. Two representations of ambiguity are used: the best estimate and the interval. Valuations are elicited using a computerized second price auction. The experiment is conducted at Max Planck Institute of economics with 80 subjects. According to the results: individuals are found to perceive two risk reduction tools as the same, ambiguity in outcome has insignificant impact on the valuations, and individual reactions to loss size ambiguity are not consistent with the predictions of any theoretical frameworks used in this study.

## **Synergy is real**

*Richard Eiser (University of Sheffield)*

■ Much research has considered how best respondents can express their understanding of synergy in terms of different probabilistic rating scales, using judgements of non-synergistic risks as a base-line. I suggest that such methodological issues are dwarfed by more conceptual ones, namely that, in real life, risks are typically – if not always – multiply determined. For example, ‘natural’ disasters arise from interactions between a range of geophysical and meteorological events and behavioural decisions by many different individuals and groups, often historically or geographically distant from the events themselves. Where a disaster cannot occur unless more than one risk factor is present, the relationship between these factors is, by definition, synergistic. Moreover, the assumption that ‘actual’ risk can be derived from the frequency distribution of previous occurrences does not hold for many rare events, or events that have never yet occurred. In the face of such complex risks, what cognitive processes are required in order to make adaptive decisions? Looking for decision rules in terms of serially combining information about separate risk factors is unlikely to be adequate, since there may be far too many risk factors to consider independently, even before then considering how to combine them. Yet we (and all other animals capable of learning) can respond to highly complex, multi-attribute stimulus arrays with rapid decisions (e.g. approach or avoidance) through parallel information processing, updated by learning. I therefore suggest that people’s understanding of real-life synergistic risks should be considered as a form of pattern recognition involving discrimination between situations judged as safer or more dangerous, based on selective personal and vicarious experience, reflective of previous behavioural decisions, and the influence of cognitive and affective heuristics.

## **Human judgments of synergistic risks: perspectives from evolutionary psychology and potential directions for risk communication**

*Ian Dawson (University of Surrey), Johnnie Johnson (Centre for Risk Research, University of Southampton), Michelle Luke (Centre for Risk Research, University of Southampton)*

■ Humans have faced a wide range of recurring risks across the course of evolution and many of these risks have occurred simultaneously. Evolutionary theory suggests that natural selection would not favour an organism that is unable to make adaptive decisions concerning the simultaneous occurrence and interaction of multiple risks. It is, therefore, surprising that recent psychological studies indicate that humans, arguably the world’s most successful apex predators, often fail to understand that certain hazard combinations present synergistic risks. In attempting to interpret these findings, this paper suggests that it is not that humans have not developed the mental architecture to understand synergistic risks, but rather that people’s understanding may often be impeded because modern hazard combinations are low in ecological validity. That is, despite having the necessary evolved psychological mechanisms (EPMs) to understand and respond to ancestrally familiar combined hazards these EPMs are less suited to understanding the synergistic risks that are presented by modern combinations, which have complex antecedent mechanisms. From this perspective, this paper argues that people’s comprehension of the synergistic risks attributable to modern hazard combinations could be improved via the use of communication formats that closely mimic the information formats which the human mind has evolved to process. In support of this thesis, this paper presents the results of a study that has identified message formats that help individuals to understand the synergistic risk attributable to a modern hazard combination. This paper argues that the success of the messages can be attributed to the use of information formats that are ecologically matched to the EPMs that have enabled humans to successfully deal with recurrent risks across evolutionary history. Such communication formats could help individuals and groups to make more adaptive decisions concerning synergistic risks.

# TUESDAY 19<sup>TH</sup> JUNE

## T1 Symposium: Risk trade-offs

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*Chair: Michael Stauffacher (ETH Zurich)*

The accumulation of knowledge transforms more and more dangers into risks (e.g., the danger of an avalanche becomes a risk when we can make some predictions about the occurrence of an avalanche). Neither governmental agencies nor industry can decide which risks people should be concerned about. Transdisciplinary research and risk-dialogues in which people's preferences and values are elicited could be promising tools for obtaining the information needed for the implementation of risk reduction measures. The decisions to focus on certain risks and to ignore other risks depend on people's values, because trade-offs need to be made. The question of how society should deal with such trade-offs will be discussed in this symposium.

### **Transdisciplinarity and Environmental Risks**

*Roland W. Scholz (ETH Zurich, Institute for Environmental Decisions)*

■ From a decision theoretic perspective, risk may be conceived as an evaluation of the loss potential related to different decision (or action) alternatives. Thus, environmental risk is involved in many situations in ranging from decision makers exposure to environmental impacts (e.g. of weather conditions, landslides, earthquakes, flooding etc. depending on one's behavior), chemicals and technologies (e.g. persistent organic pollutants, engineered nanoparticles, nuclear technology) or to impacts of slow and sometimes delayed rebound effects of human induced changes of the environment (e.g. climate or ecosystems change). We suggest that environmental risk management is a matter in which public risk perception should interact with scientific risk assessment. This would ask for transdisciplinary processes in which multi stakeholders (practice/society) should relate their knowledge with science based risk assessments for better understanding of the loss potential (capacity building) and consensus formation about the acceptability of risks and

vulnerabilities related to decisions/accents. We discuss how transdisciplinary processes may incorporate risk management as an important aspect of societal/social preference formation and how it may be related to the goal of designing resilient systems.

### **Flood risk management and risk-based decision making**

*Bruno Merz (Helmholtz-Zentrum Potsdam Deutsches GeoForschungsZentrum (GFZ))*

■ Traditional flood protection has focused upon the definition of a design flood event and specification of systems that are intended to prevent flooding in conditions of that severity. Over the past one or two decades, there has been a constant call for moving from flood protection to flood risk management. Flood risk management addresses a full range of events, including those that exceed the design standard. Further, it encompasses risk-based decision making, where estimates of flood risk, the costs of options and any other costs and benefits, form the basis for decision making. Central to risk-based decision making is the idea of a proportionate response to risk, so that the amount invested in risk reduction is in proportion to the magnitude of the risk and the cost-effectiveness with which that risk may be reduced. This contribution gives an overview about risk-based decision making in the area of river floods, and discusses some of its possibilities and limitations.

### **Climate change risk analysis for transparent adaptation decision making**

*Niels Holthausen (Ernst Basler + Partner), Pamela Köllner-Heck (Federal Office for the Environment FOEN), Michael Bründl (WSL Institute for Snow and Avalanche Research SLF), Sabine Perch-Nielsen (Ernst Basler + Partner), Marco Pütz (Swiss Federal Institute for Forest, Snow and Landscape Research WSL), Peter Locher (Ernst Basler + Partner), Thomas Probst, Roland Hohmann (Federal Office for the Environment FOEN)*

■ Appropriate climate change adaptation relies on sound information on the expected impacts of climate change. We propose a semi-quantitative approach for climate risk analysis on regional or national scale to generate adequate information and to support the responsible authorities. Our approach focuses on the impacts on several policy areas, e. g. health, agriculture and infrastructures. The effects of climate change are separated in related hazards and developments (from short-term events to long-term changes), e. g. storms, heatwaves, rise of mean temperature. The analysis accounts for the annual variation of climate-related hazards by defining probability density functions for quantifiable



annual effects of each hazard. These enable an aggregation of annual risks by Monte Carlo simulation for each of the policy areas and/or for each of the hazards. Also qualitative information on climate change impacts are recorded and considered in the results. We compare the today's risks with those projected for the future (2060). For that purpose we calculate the future risks using two different climate change scenarios and one socio-economic and demographic scenario to allow a comparative judgement of the effects of both.

Climate change risk analyses have to cope with considerable uncertainties of parameters, e. g. about future climate change, its effects on climate-induced hazards and future exposure. Our approach accounts for uncertainties by considering sensitivity analyses of key assumptions. The results allow a transparent prioritisation of climate change impacts from a risk point of view. They provide a valuable basis for the discussion of climate change adaptation priorities among responsible administration units and stakeholders.

## T2 Nuclear risk

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*Chair: Roman Seidl (ETH Zurich)*

### **Communicating nuclear risk in a distrusted environment in China**

*Guizhen He (State Key Laboratory of Urban and Regional Ecology, Research Centre for Eco-Environmental Sciences, Chinese Academy of Sciences), Lei Zhang (School of Environment and Natural Resources, Renmin University of China), Arthur P. J. Mol (Environmental Policy Group, Wageningen University, The Netherlands), Yonglong Lu (State Key Laboratory of Urban and Regional Ecology, Research Centre for Eco-Environmental Sciences, Chinese Academy of Sciences)*

■ The Chinese leaders have reiterated the significance of credibility for both the government and society, as a response to the fact that "credibility" has become a much-discussed term among the public in recent years and governmental failure to cope with increasing frauds and crisis in many sectors have made Chinese citizens suspicious of virtually everything. Japan's Fukushima nuclear crisis following the tsunami on March 11, 2011 dominated the primary TV programs, newspaper and in internet has a great effect on

the public trust and credibility of the government. Fukushima nuclear disaster put a chill on much of the world's nuclear power industry, but not China. China seems to continue steadily with expanding its nuclear industry. Pending successful completion of China's Medium- and Long-term Nuclear Power Development Plan, China will enter an era of nuclear power. Accompanying this progress are growing risks associated with nuclear power plants. However, the general Chinese public knows little about nuclear risk and its risk management. The reactions of the Chinese people during the Fukushima nuclear crisis indicated that lack of knowledge and effective communication on nuclear risk could cause confusion and chaos in similar crisis. The fact that problems in two major factors – credibility of the society and public trust of the government – is hindering the progress of the entire Chinese society. The question is then: on nuclear power risk in China and decision on its future, who needs communicate with whom on what and how and why? By interviewing the key stakeholders and conducting questionnaire survey, this study aims to understand the current politics around nuclear power risk communication in China through analyzing the interactions between different stakeholders involved in Haiyang nuclear power plant, Shandong Province.

### **The ethical acceptability of multinational nuclear waste repositories**

*Behnam Taebi (Delft University of Technology)*

■ The post-Fukushima future of atomic power is still uncertain, but one thing we can be certain about is the fact that whatever happens we need to deal with the legacy of half a century atomic power production. The safe disposal of nuclear waste is a global challenge that faces humanity. There is international consensus that the producing country remains responsible for geological disposal of its own waste, but there is also a growing urge to consider regional or multinational repositories, particularly in Europe where ten EU countries are currently exploring their feasibility (please see <http://www.erdo-wg.eu>). These joint solutions will precipitate very many legal, political and financial issues that should be addressed but the ethical considerations they spawn deserve serious attention too. I argue that we should contemplate their ethical acceptability within the realm of a conflict between intergenerational and intragenerational justice; i.e. they are favored from the perspective of justice to future generations and disfavored from the viewpoint of justice among contemporaries



In this presentation, I will first explore how the issue of long-term protection against radiological risk has been approached in various publications of the ICRP, IAEA and the NEA. Two types of future exposure to radiation risk could happen: namely 1) natural leakage due to the degradation of waste packages and the transport of radiation into the biosphere and 2) (unintentional) human intrusion into these repositories. I argue that multinational repositories could help reduce the risk of future exposure by choosing a favorable geological environment and by reducing the number of these facilities holding risks for the future. Multinational repositories, however, give rise to intragenerational injustice, since one nation is supposed to accept other nations' waste. This gives rise to the question of which of these two justice notions is morally more compelling. I will finalize the presentation with discussing the philosophical challenges of comparing spatial and temporal risks, and at a more fundamental level, of reconciling intragenerational and intergenerational justice.

#### **Beyond risk perception: the role of perceived adaptive capacity for the acceptance of contested infrastructure**

*Corinne Moser, Michael Stauffacher, Yann B. Blumer, Roland W. Scholz (ETH Zurich, Institute for Environmental Decisions)*

■ Infrastructure projects like repositories for nuclear waste or hazardous waste sites impose risks over timescales up to one million years. These risks, however, dynamically change over time and so does their management, as societies go through learning processes and subsequently might be better able to manage challenges arising from such infrastructures. However, social scientific research about the acceptance of such projects is mainly concerned with risk perception issues and does not include such dynamic aspects. The concept of adaptive capacity, which includes a dynamic perspective, therefore represents a promising complementing facet for this line of research. The aim of this paper is to examine the role of perceived societal adaptive capacity for the acceptance of contested long-term infrastructure, for the two examples of nuclear and hazardous waste. In an experimental setting (N = 300) examining the acceptance of a nuclear waste repository or a hazardous waste site we demonstrated that i) perceived adaptive capacity can be separated empirically as a psychological construct from risk perception and benefit

perception and ii) perceived adaptive capacity explains a significant additional share of variance in acceptance of a hazardous waste site or nuclear waste repository besides respective risk and benefit perception. Thus, including a dynamic perspective yields important insights for understanding individual decision processes regarding long-term infrastructure projects.

#### **Public values and the siting of contested infrastructure. Considerations concerning a prospective Swiss radioactive waste repository.**

*Roman Seidl (ETH Zurich)*

■ Locally unwanted land uses or siting of contested infrastructure such as waste incinerators, landfills or energy infrastructure (e.g. deep geothermal, wind power) are examples where the design of the siting process plays a crucial role for the acceptance by local inhabitants. Participation of stakeholders including the broader public is one way to receive local concern and risk perception in the decision process. Participatory processes are especially meaningful and yield added value if the issue at hand is value laden, solutions are ill-defined, the situation is wicked. In the presentation we refer to a specific case in Switzerland to illustrate the potential relevance of public values for the acceptance of a repository for high level radioactive waste (HLW). We conducted 42 semi-standardized personal interviews with participants of a preceding questionnaire survey (N = 500). The focus was on the importance of values for the perception of the participatory process. We used open questions and illustrative material to get into a dialogue with participants about how they perceive the participatory process and the discourse about the repository. We also asked participants to bring aspects related to the process design written on cards into a rank order according to their opinion. We show that – besides safety issues, which are of utmost relevance for the opinion about a planned repository itself – values such as transparency, independence from political influence, and honest communication are key factors for the perception of the participatory process. We conclude that, first, interviews are a proper means to get access to the values of people related to socio-technical issues and, second, that a careful design of the process itself, taking into account the different values of the public might be crucial. Our study provides considerable insight on which key factors one should focus.

# T3 Food risks: information seeking and communication

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*Chair: Astrid Epp (Federal Institute for Risk Assessment BfR)*

## **Determinants of information seeking about food risks**

*Femke Hilverda, Margôt Kuttischreuter (University of Twente)*

■ Recent years have seen a number of incidents involving micro-biological contamination of food products. One of the latest examples is the contamination of fenugreek seeds with the EHEC in Europe. This contamination led to the death of tens of people. Such incidents usually lead to anxiety among consumers, a need for extra information and possibly information seeking behaviour. We can question what it is that motivates people to seek additional information in such situations, and how people deal with this information. This study gives insight in what factors determine information seeking behavior and which individuals are more inclined to search for extra information. The focus of this study is on the risks of fresh vegetables.

Based on the Risk Information Seeking and Processing model, a model describing the factors determining information seeking is tested. One of the determinants included in the model is risk perception. That is, it is predicted that the more dangerous the risk is perceived, the more individuals are inclined to seek for extra information. Also trust is an important determinant in the model, in particular trust in the integrity of food industry and trust in the competence of authorities to adequately deal with risks.

A cross-national survey has been carried out in nine European countries (n = 7200). Subjects were questioned about their information seeking behaviour and a number of potential determinants such as risk perception, trust, and information sufficiency.

The presentation of the results focuses on the main determinants of information seeking, such as how the risk is perceived. Following regression analyses, structural equation modelling is applied to test the model using AMOS. Results show what concepts are most important in explaining information seeking, how people deal with information, and what individual characteristics may account for differences in information seeking intent. Consequences for food risk communication are discussed.

## **Journalists and digital citizen contributors relationships. New identities and roles to be played in food risks/benefits communication.**

*Jordi Prades, Jordi Farré (Rovira i Virgili University)*

■ Periodically, crisis related with food have marked the media and policy agenda within the EU, and risk communication has become a central issue to take into account. New channels and digital tools are critical in definition of issues and in risk perceptions related with food. In the blurring boundaries of new media environment, journalist/media professionals and sources/claim-makers are playing new roles. The main aim of this paper is to identify these roles (exemplars, experts, reflectors, commentators, co-workers, bloggers, communities and so on) and to identify linkages among issues and channels, in order to exploring to what extent social media are redefining professional and digital identities (traditional, dialogical and/or ambivalent) or changing routines in the meaning-making process. This theoretical framework will allow us to identify main opportunities and barriers to communicate food risks and benefits both in crisis scenarios and in normal situations, and to improve best communicative practices. This paper also seeks to identify sources required and/or available for journalists, data validation, seeking information, routines and job, participating practices, training-expertise and behaviors in specific crisis related with food. This article is based on WP2 FoodRisC project, funded under the European Union Seventh Framework Programme.

## **Chemical risk in food: comparing web- and paper-based communication tools**

*Giulia Mascarello (Istituto Zooprofilattico Sperimentale delle Venezie, Italy), Stefania Crovato (Istituto Zooprofilattico Sperimentale delle Venezie, Italy), Barbara Tiozzo (Istituto Zooprofilattico Sperimentale delle Venezie, Italy), Corrado Petrucco (Università degli studi di Padova, Italy), Michael Siegrist (ETH Zurich), Licia Ravarotto (Istituto Zooprofilattico Sperimentale delle Venezie, Italy)*

■ The planning and realization of an effective food risk communication campaign should consider two aspects: the choice of the most adequate communication tool, and the increasing importance of the direct involvement of the target in defining both content and the communication strategy to be adopted. The research project “Chemical risk in food: comparing web- and paper-based communication tools”, promoted by the Istituto Zooprofilattico Sperimentale delle Venezie (IZSve) and funded by the Italian Ministry of Health, intends to test two different communication tools and compare their efficacy and

ability to meet the expectations of the selected target (high school students). Moreover, the study develops a new methodology to build communication campaigns through a participatory process. The double advantage of this methodology is that, while defining a communicative message in accordance with students' social context, it also develops a process of learning-by-doing for the target group. The communication message was elaborated through the narrative technique, which is recognized as a strategy capable of facilitating the comprehension of scientific contents and, therefore, promoting more effective learning through emotional involvement of the audience. The story, which was created by 50 high school students and based on their personal experiences, provides scientific information on selected chemical risks in food and some strategies for their prevention. The communicative campaign was presented to a sample of 400 students (16–17 years old) living in North Eastern Italy using two different tools: digital- and paper based. The students' preferred communication tools and their perception of the tools ability to suit the target group and transfer scientific knowledge were evaluated. The results of this comparison provide useful information for institutions dealing with risk communication and health care to design effective communication campaigns on chemical risk in food, with the aim to promote good eating and food handling practices among young consumers.

#### **Pesticide residues in German media – analysis of media coverage**

*Astrid Epp (Federal Institute for Risk Assessment BfR)*

■ Because of regularly media coverage pesticide residues in food are of high public interest. In addition, the way media frame a topic has often a strong impact on the public's perception of that topic. To gather the facts and get more detailed information about the framing of the topic pesticide residues in food in German Media, the German Federal Institute for Risk Assessment (BfR) issued a media analysis in 2011. This analysis examines German media coverage of pesticide residues between January 2003 and December 2010. The media analysis incorporates articles published in the national quality newspapers *Frankfurter Allgemeine Zeitung*, *Süddeutsche Zeitung*, *taz*, *die tageszeitung*, *Frankfurter Rundschau*, *Die Welt*, *Financial Times Deutschland*, the news magazines *Focus* and *Der Spiegel*, the weekly newspaper *Die Zeit* and the tabloid *BILD Zeitung*. The central question of this long-term analysis is: how is the topic pesticide residues presented in the media? Therefore, the analysis is primarily concerned with the determination of the scale of media reporting on the subject pesticide residues, on the topics and interpretation frames

and on the actors who are present in the media coverage. In addition, the analysis focuses on possible changes in the scale of reporting since 2003. The content and results of the media analysis will be presented, as well as their relevance to a media-oriented risk communication strategy for BfR.

## **T4 Symposium: Risk perception and risk communication in the medical context**

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*Chair: Carmen Keller (ETH Zurich)*

Utilizing various methods, the symposium will provide an overview of current studies on risk perception and risk communication in the medical context. In recent years, research has identified various processes and factors that influence the perception of risk, which have to be taken into account in medical risk communication. In the symposium, current research on some of these processes and factors will be presented. The first two presentations involve the use of functional magnetic resonance imaging (fMRI) to study intuitive, affective, and cognitive processes underlying risk perception. In the first of these, results of various studies examining intuitive processes underlying HIV risk perception will be presented. The second examines the neural and cognitive mechanisms in high- and low-numerate individuals that underlie their perception of risk, as presented in medical risk communication formats. It explores whether numeracy-related differences in affective processes and different abilities to represent and process numerical magnitude information may account for the effect of numeracy on risk perception. The third presentation concerns an experimental study that examines biased risk perception. An alternative method is suggested for assessing the degree to which people evaluate the risk involved in behaviors when they show the respective risk behaviors, compared to when other people show these behaviors. The fourth presentation examines the influence of format on measuring subjective probability judgments. Several experiments will be presented, in order to evaluate various self-report instruments in the context of vaccination risks. Practical implications for risk perception research and communication in the medical context will be discussed in the symposium.

### **Measuring subjective probability in the context of vaccination risks**

*Niels Haase, Frank Renkewitz, Cornelia Betsch (University of Erfurt)*

■ Risk is commonly construed as a combination of the perceived likelihood and the expected severity of an event. Comparing studies in risk research however is almost impossible since there is no standard measure for subjective probability. The goal of this contribution was to evaluate various self-report instruments for subjective probability judgments. Experiment 1 examined the performance of five commonly found formats – two rating scales, a visual analog scale and two numeric measures – in terms of their accuracy and context dependency as well as their relation to a general risk measure. We found that numeric formats outperformed all other measures while increases in probability as well as in severity of the events to be judged led to general decreases in performance. These effects, however, depended heavily on whether the probability information had to be sampled sequentially or was described graphically. Descriptive encoding, i.e. ensuring perfect information, improved accuracy and diminished context dependency. Experiment 2 followed up on this effect. The probability information had to be sampled while encoding conditions were made more difficult by reducing the presentation time of individual exemplars and presenting different events concurrently in one sequence. The worst and best performing measures – a 7-point rating scale and a percentage format – were compared with regard to the same criteria as before. While the rating scale remained context dependent the reduction of available information led to a marked decrease in accuracy for both formats. However, the differences between formats disappeared, i.e. when probability information was highly error-prone, both measures performed on par with each other. The results stress the importance of considering the specific research question and research design when choosing a measure for subjective probability.

### **Neurocognitive mechanisms underlying effects of numeracy and mathematical competence on health risk perception**

*Roland H. Grabner (ETH Zurich), Carmen Keller (ETH Zurich), Karl Koschutnig (University of Graz), Franz Ebner (Medical University of Graz), Gernot Reishofer (Medical University of Graz), Simone Dohle (ETH Zurich), Michael Siegrist (ETH Zurich)*

■ Individual differences in numerical and mathematical abilities have been found to exert a considerable impact on the perception of health risks. Previous studies using assessments of numeracy have revealed that low-numerate individuals tend to overesti-

mate small risks and to report larger concerns than their high-numerate peers. The neural and cognitive mechanisms underlying this effect, however, are currently not well understood. On the one hand, it has been argued that it is due to numeracy-related differences in affective processes. On the other hand, recent evidence suggests that individuals of lower and higher mathematical competence also differ in the ability to adequately represent and process numerical magnitude information and that this could also account for this effect. In the present study we used functional magnetic resonance imaging (fMRI) to evaluate both hypotheses. In addition, by assessing participants' subjective and objective numeracy as well as mathematical competence using psychometric tests, we sought to investigate which ability measurement is most strongly related to performance and accompanying brain activity. During fMRI acquisition, adult students worked on two tasks in which pictograms displaying natural frequencies between 1 and 99 were presented. In the first task, they were asked to imagine that the pictograms show the probability of having cancer and to judge on a graphical number line how concerned they would be about each result. In the second task, similar pictograms and number lines were presented but participants were only required to estimate the position on the mental number line that corresponds to the numerical information of the pictogram. The data acquisition is not yet completed. In the analysis, we will (a) contrast both tasks with respect to the effects of numeracy and mathematical competence and (b) compare the associations of different measures of numerical and mathematical skills with performance and brain activity.

### **Risk perception and neuroscience: new perspectives on health psychology**

*Harald Schupp, Ralf Schmälzle, Britta Renner (University of Konstanz)*

■ In health psychology, the perception of risks is commonly conceptualized as the outcome of deliberative reasoning. Specifically, the complex topic of how people think about risk has been condensed into only two core variables, i.e., perceived probability and perceived severity. Theoretically, this 'risk as analysis' perspective has been contrasted with the 'risk as feeling' view, which postulates that risk is perceived intuitively. However, the assessment of intuitive processes is notoriously difficult. Neuroscientific measures may help to fill this gap. A series of ERP and fMRI-studies is presented examining the role of cardinal features of intuitive processes in the context of HIV risk perception. In two studies, participants viewed portraits of unacquainted persons and provided explicit ratings of HIV risk. Results showed that risky compared to safe persons elicited distinct ERP modulations

within the first three hundred milliseconds of stimulus processing, presumably reflecting automatic person evaluations eluding introspection. Furthermore, consistent with previous findings reporting augmented LPP amplitudes to affectively significant stimuli, risky persons elicited an increased late positive potential. These findings have been extended in two further studies to the implicit perception of risk. ERP and fMRI data reveal the differential processing of risky as compared to safe persons measuring brain activity to photographs of unacquainted persons while participants performed a task that did not mention HIV risk. Overall, these studies support the notion that intuitive processes may underlie the perception of health risks. Implications of these findings for risk perception are discussed.

#### **It's different when I do it: assessment of unrealistic optimistic risk perceptions at the individual level**

*Britta Renner (University of Konstanz)*

■ When people are asked to rate their chances of experiencing certain illnesses, accidents and other problems, most of them report that their risk is below average. However, such relative risk estimates do not reveal which individuals are actually biased. Most researchers to date suggest that unrealistic optimism can only be determined by reference to an objective standard of accuracy such as detailed knowledge about individuals' risk factor profile and the epidemiological risk of similar people (e.g., Weinstein, 2003).

In the present study, an alternative method is suggested for assessing unrealistic optimism at the individual level. Two samples (N = 116 and N = 98) were asked to report their sexual risk behavior and their perceived risk for becoming infected with HIV or Chlamydia. Afterwards, they were given behavioral profiles of hypothetical others and they were asked to estimate the risk of becoming infected for each of these hypothetical targets. Importantly, one of the hypothetical targets showed a behavioral profile comparable to the rater ("risk twin"). In the "risk twin" condition, the self and the hypothetical target were virtually identical. This approach allows to determine if people evaluate risk behaviors as less risky when they show the respective risk behaviors compared to when other people are showing them. Results showed in both samples that most participants perceived themselves less at risk than the "identical" risk twin indicating a clear optimistic bias in risk perceptions. Implications for the assessment of risk perceptions are discussed.

## T5 Safety in organizations

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*Chair: Ragnar Rosness (SINTEF Technology and Society)*

#### **Operational risk due to emergence and systemic effects in ICT-mediated collaboration**

*Tor Olav Grøtan (SINTEF Technology and Society)*

■ The specific field of interest is operational risk related to Integrated Operations (IO) in the Norwegian offshore petroleum sector. IO is seen as an example of a broader class of complex systems and ICT-driven organizational transformations, encountering what may be characterized as emergent operational risks of a systemic kind.

The main issue is the elaboration of the concept of Emergent and Systemic Operational Risk (ESOR), with reference to, e.g., the IRGC framework. ESOR targets systemic aspects of operational risk stemming from (1) intentional re-contextualization of risks, hazards and threats (previously known in specific contexts), and (2) generic hazards and threats related to technically mediated, sociotechnical and symbolic communication and interaction. By implication, the impact of IO as a representative of ICT-driven organizational transformation will go beyond the perspective of ICT as (only) critical infrastructure.

The presentation will employ a somewhat radical complexity perspective to conceive surprise encountered through operational risk as something fundamentally more than just uncertainty or ambiguity of prior expectations and predictions. This perspective encompasses social emergence and complexity in organizations as more radical than material complexity, and also recognizes the heterogeneity inherent in the combination of human, technical and organizational entities, e.g. as expressed from an actor-network theory (ANT) point of view. The complexity perspective employed thus accommodates a dynamism that is signified by the observation that "the act of playing the game has a way of changing the rules".

Methodologically, the discussion will be based on the Cynefin sensemaking framework. From this, a Composite Complexity Model (CCM) based on a categorization of various sources of complexity is developed.

The resulting CCM constitute a framework for reflection on the ESOR kind of risks. Examples of its possible use and comprehension may be drawn from air traffic system and for offshore oil and gas exploration and production. E.g. it will be argued that although

there are no "black swans" in terms of technical failure modes, serious accidents (may) happen because blind spots ("black swans") are actually produced in the surrounding social system.

### **Relationships between leadership and employees' risk and safety perceptions, attitudes and behaviours within civil and military contexts.**

*Marcus Borjesson, Ann Enander (Swedish National Defence College)*

■ Probably the most studied dimension in research on safety in organisations is management safety, which refers to employees' perceptions of their supervisors' regard for and commitment to safety (Seo, Torabi, Blair & Ellis, 2004). Although there is quite robust support for associations between leadership and safety issues, there remain questions to be answered regarding for example how different leadership styles and behaviours affect different safety perceptions, attitudes and behaviours among employees and how these relationships are expressed in different contexts. One interesting context is the military, where safety and risk issues are highly salient, but research knowledge about these issues and leadership seems to be limited. In a series of both civil and military studies we examined the relationships between leadership and subordinates' perceptions, attitudes and behaviours regarding safety and risk issues. In this paper we present some preliminary findings from these studies.

Survey data were gathered from six different companies within the Swedish process industry (n = 434), one group of military conscripts (n = 389), one military marine group (n = 141), one group of military soldiers (n = 113) and finally a group of military officers (n = 130). Preliminary findings indicate that safety-specific leadership behaviours have a significant effect on employees' safety perceptions, attitudes and behaviours within both civil and military contexts. For example, safety-specific leadership seems to be influencing subordinates perception of safety communication and in turn also their attitudes and behaviours in relation to safety. However, the particular context of the military, involving a need to balance safety concerns with deliberate exposure to risks, is reflected also in leadership behaviours which combine these aspects. Implications of different leader behaviours for safety in civil and military contexts respectively are discussed.

### **Building safety in fragmented organisations**

*Irene Wærø, Ragnar Rosness (SINTEF Technology and Society)*

■ During recent decades we have seen two parallel trends towards (1) increasing integration and complexity of technical systems and (2) increasing fragmentation of organisations (e.g. outsourcing, deregulation). The second trend and the interaction between these two trends may deserve more attention than they have received until now in risk research.

The aim of this paper is to contribute to an understanding of how actors in fragmented organisations may act to maintain a capacity to build safety. We will propose a conceptualisation of environmental conditions for safety work and present empirical results concerning (1) what environmental conditions actors in the Norwegian petroleum industry find important for their capacity to build safety and (2) how they go about to improve their environmental conditions and to adapt to the conditions that they cannot easily change. Environmental conditions for safety work refer to conditions that influence the opportunities an organisation, organisational unit, group or individual has to control the risk of major accidents and working environment risk.

The paper will summarise results from an exploratory case study based on qualitative interviews with 30 persons from three contractor hierarchies in the Norwegian petroleum industry. The environmental conditions that the interviewees found important for their safety work can be categorized into dynamic conditions that are built and maintained through collaboration such as careful planning of activities and more stable conditions such as work place layout and procedures. The results further demonstrated a high level of awareness concerning the significance of how individuals and groups interact and build long-term relationships across organisational boundaries. To achieve this, the interviewees emphasised values such as open-mindedness, equal status, inclusion and sharing of knowledge. They identified interaction over extended periods of time as a precondition for building safety.

### **Environmental conditions for safety and the responsibilities of senior management**

*Ragnar Rosness, Ranveig K. Tinmannsvik, Irene Wærø (SINTEF Technology and Society)*

■ The purpose of this study was to explore how senior management decisions may influence the risk level by influencing the environmental conditions for safety work facing intermediate management levels and operators. By "environmental conditions for safety work", we refer to conditions that influence the opportunities an organisation, organisa-



tional unit, group, or individual has to control the risk of major accidents and work environment risk.

The study is based on a review of literature concerning the explosion at BP's Texas City refinery in 2005. We identified plausible connections between (1) decisions made at senior and intermediate management levels, (2) environmental conditions facing intermediate management and operators, and (3) the sequence of events leading to injuries and material damage.

The cost reductions imposed by BP senior management led the Texas City refinery management to apply cost reduction strategies that weakened the status of physical barriers against fires and explosions and at the same time put the operators in an inferior position to keep the hazards under control. BP senior management also influenced the environmental conditions of lower levels of the organization by abolishing the central safety department after the merger with AMOCO, and by introducing an incentive system that failed to take into account process safety.

We conclude that senior managers may exert a significant influence on process safety by the ways their decisions influence environmental conditions of intermediate management levels and operators. Intermediate management levels exert an influence through the degree to which they accept or resist conditions imposed by higher management levels, and through the actions they take to adapt to their own environmental conditions. There is a need for practices and tools that increase the awareness of senior managers of how their decisions influence the environmental conditions for safety work at lower levels in the organization.

## T6 Symposium: Risk governance

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*Chair: Peter Greminger (Federal Office for the Environment FOEN)*

In industrialized countries, governments try to reduce the risks people are faced with. This is done through subsidies, regulations, prevention measures, taxes and information campaigns. All these measures have a price tag, however. The increased number of risks we can deal with means that more and more money is used for risk reduction. The question, which risks should be reduced and what price society is willing to pay for such risk reduction, becomes a relevant topic. The goal of this symposium is to better understand how risks across various fields can be compared, and how best to invest the money in risk reduction. Furthermore, the role of government in risk management will be discussed.

### **Inclusive governance: public participation in risk decision making**

*Ortwin Renn (Universität Stuttgart)*

■ The notion “risk governance” refers to an integrated concept on how to deal with environmental problems, and so-called complex, ambiguous and uncertain impacts in particular. These ideas have been informed by interdisciplinary research drawing from sociological and psychological research on ecological behaviour, Science & Technology Studies (STS) and research by policy scientists and legal scholars about regulatory styles, institutional regimes and structural impediments to more inclusiveness. The notion of governance pertains to the many ways in which all relevant actors, individuals and institutions, public and private, deal with interventions that impact the environment and its service to human societies. It includes formal institutions and regimes and informal arrangements.

The term inclusive governance refers to a policy style by which different actors, in particular, governmental actors, experts, private companies and representatives of civil society are invited and welcomed to consult decision makers or even co-determine key policies and decisions for risk reduction and mitigation. For this purpose new procedures for stakeholder involvement have been developed and partly tested. Beyond this horizontal level of inclusion environmental policies have to be aligned to the vertical levels, starting from the local, over the regional, national to the EU or even international level. Both directions, representing the vertical and horizontal governance dimensions, face many challenges and problems.



The lecture will introduce the major governance functions in a multilevel political and social environment particularly for environmental risks such as climate change, water scarcity, biomass conversion and others. It will summarize the attempts to secure support for collective action, feeding in plural preferences and designing cooperative measures. It will conclude with some general lessons for future research and practical applications.

### **Better regulation in Europe: next steps**

*Ragnar Löfstedt (Kings College London)*

■ Over the past 30 years there have been discussions throughout many parts of Europe on how to implement better regulation procedures. One of the primary goals of these procedures is to reduce unnecessary and non-science based regulations from the rule books, and to ensure that the regulations being drafted in Europe be they in the food, health and safety or environmental sectors are based on the best available evidence. To date the better regulation measures that have been put forward have not been as successful as they could have been. In this talk the author discusses whether some of the measures he proposed in a recent UK government Review, such as establishing a European Parliamentary Committee to look at risk based policy making, will help ensure that future European directives and regulations are evidence, risk and science based.

### **Risk management of the Swiss Confederation**

*Raffaele Chiacchia (Schweizerische Bundesverwaltung)*

■ Risk management of governments are multifaceted and complex and pose several challenges. In today's environment with the emergence of very complex and interdependent risks a broad approach for risk governance is needed.

The Swiss federal administration's risk management is (mainly) based on the Federal Budget Ordinance (Art. 50) and on a directive of the Federal Council. It's focus and primary goal is to support the performance of tasks and fulfillment of objectives of the Administration by improving the decision-making process on all levels.

As the risks are very different and the departments are very independent the risk management in the Federal Administration is organized in a decentralized and flexible manner. For an efficient allocation of resources to minimize the risks a methodical framework is installed which helps and enables the comparison of the very different risks the government faces.

The next step in developing the risk management framework of the Federal Administration to the next level will be to face and resolve the following challenges:

- Facilitate the use of the results of risk analysis in the decision-making processes (financial and strategic planning) within the federal administration to ensure the efficient allocation of resources to minimize risks.
- Developing and improving an open risk culture and awareness in order to facilitate the discussion and dialogue about risks within the administration (between different departments and offices) and to improve the early identification of new emerging risks and crises.

## **T7 Energy systems: the public's view**

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*Chair: Olivier Salvi (INERIS)*

### **Beyond the backyard. Wind farm wars from a risk conflict perspective**

*Yves Pepermans, Ilse Loots, Pieter Maesele (University of Antwerp)*

■ In this article, we argue that conflicts about the siting of wind farms should not be understood as conflicts about the preservation of backyards, but as local risk conflicts where societal actors selectively use different methodologies, images, information sources and knowledge claims to meet their values and interests and frame them as the general interest. Our research design includes a qualitative framing analysis of three wind farm siting announcements in Flanders through interviews with stakeholders, a collection of relevant communication and policy documents and an analysis of the announced siting in the press. Identifying four frames which focus on different aspects of a wind farm, we find that the proponents argue that communities must sacrifice some lesser environmental goals and goods to prevent catastrophic climate change. We argue that framing a wind farm as a trade-off between environmental costs and benefits, justifies and excuses inaction at the local level due to the abstract nature of the risks associated with climate change, compared to the tangible consequences of wind farms. Second we find that, the information-deficit model, which sees the lack of public understanding as the cause for opposition, is still dominant in wind farm planning. We conclude by writing that public

engagement around renewables should focus on building trust and finding legitimate decisions, instead of striving for consensus through more one-way communication.

### **Contested energy risks in context: using a whole system lens to explore low carbon transitions with the public**

*Karen Parkhill, Catherine Butler, Nick Pidgeon (Cardiff University)*

■ Energy system change bears upon multiple long-term UK national and international policy goals, including the transition to a sustainable low carbon economy, energy security and affordability, and mitigation of climate change. We report findings from innovative qualitative deliberative workshops with members of the public held in Scotland, Wales and England during the summer of 2011 investigating perceptions of whole energy systems transformations. These workshops included whole group discussions, multi-modal methods (i.e. group work with an online energy scenario building tool), and small group work with scenario narratives. Although participants were asked about how they felt energy is and should be supplied (e.g. nuclear, renewables, fossil fuels and carbon capture and storage), a whole system focus prompted and challenged participants to take account of how their choices interact with other aspects of system change such as energy use and demand management. Our paper will focus on how using a whole system lens makes more visible the complexities and interdependencies within and between both supply and demand sides with important consequences for public responses to energy infrastructure. The methodological challenges of representing the complex interconnections, lifestyle implications and varied risks and benefits embedded within whole energy system transformations in meaningful ways for lay participants, are also discussed.

### **Success factors for participatory procedures in deep geothermal energy projects**

*Matthias Holenstein, Lasse Wallquist (Risk Dialogue Foundation)*

■ It is widely recognized that participatory procedures lead to increased acceptability of decisions made about the deployment of new technologies with complex risk characteristics. In the present study, we examine success factors for participatory procedures involving the general public and other stakeholders in deep geothermal projects. We draw on three case studies of participatory dialogues with stakeholders and local citizens, conducted during deep geothermal energy projects in Switzerland and Germany. Success is measured by the stability of the decisions shaped by the conducted participatory proce-

dures. Our results suggest that broad and context-specific risk management (including technical, economic, social and ecological aspects) as well as an honest commitment of the project developer to involving the public form the basis for sound participation. The general aim of the participatory procedure should be to form an acceptable project or decision but not to create acceptance of an existing project. It is important to consider local issues and to start participatory procedures as early as possible. Transparency during the project and open-ended decisions increase trust and are other prerequisites for success. Giving a pseudo-voice to local citizens may even backfire and raise the potential of public protest against the project. Individuals or groups that may be harmed by the project need to be given special attention. Moreover, it might be beneficial for the stability of the decisions made to involve local citizens by offering the possibility of making financial investments in the geothermal project. In our three case studies, we gained broad support from our participants for the early involvement of stakeholders including the general public. We conclude that local participatory dialogues are helpful for reaching stable political decisions about the deployment of deep geothermal projects and other technologies with complex risk characteristics.

### **Risk management in the development of new energy technologies**

*Olivier Salvi, Sébastien Evanno (INERIS)*

■ New energies are experiencing a great development in the world and particularly in Europe. The main purpose is to find an alternative energy replacing the fossil energy dependence which is more sustainable and reduce CO<sub>2</sub> emissions. Nevertheless, new energy produced by new technologies often generates new risks that have to be properly addressed to guarantee that the transition to a new energy mix with more renewable energy will be performed safely and reach a wide public acceptance.

The paper first presents the analysis of the current situation in Europe with the development of renewable energies under the impulse of strong regulations such as the Renewable Energy Directive (Directive 2009/28/EC) and the European Strategic Energy Technology Plan (SET-Plan), as part of the Energy and Climate Change policy framework. In particular, in the Energy 2020 strategy, A strategy for competitive, sustainable and secure energy communicated on November 10<sup>th</sup> 2010, the Energy Commissioner, Günther Oettinger, insists on 2 aspects:

- The renewable energy technologies should respect the principles of public acceptance (Priority 2, Action 3),
- The level of safety and security of the new energy technologies should be similar to the current situation or even improved (Priority 3, Action 2).

Therefore to guarantee the acceptance by the public it is necessary to put in place an efficient risk management for the new or emerging risks.

In a second part, the approach and tools developed by the iNTeg-Risk project (Early Recognition, Monitoring and Integrated Management of Emerging, New Technology related Risks, see <http://www.integrisk.eu-vri.eu/>) is applied to the biogas energy.

In a third part, from this experience, the benefices of the iNTeg-Risk approach for the management of new and emerging risks in the energy sector are generalized.

## T8 Stakeholder perception of food risks: comparing experts and lay people

*Chair: Alexandra Zingg (ETH Zurich)*

### **Stakeholder concerns and risk perception about intensive animal production systems influencing the debate about public health decision making in the Netherlands.**

*Marleen Kraaij-Dirkzwager, Erik Lebrecht (Rijksinstituut voor Volksgezondheid en Milieu, National Institute for Public Health and the Environment)*

■ Economic incentives lead to large-scale animal husbandry in the Netherlands, a country with a high density of both animals and people. The governance of health risks related to intensive animal husbandry is broadly debated. The debate includes different stakeholder perspectives and issues of health, animal welfare, sustainability and economic viability. Discussions heated up by a recent Q-fever outbreak and emergence of antibiotic resistant pathogens. This project aimed to identify stakeholders and concerns in the debate on Intensive Animal Production Systems (IAPS), for future improvement of the governance of health risks related to animal husbandry. An exploratory literature review was performed, searching for frameworks and methods to perform a concerns assessment. Recent publications on IAPS (and health) and ten semi-structured interviews with key

informants were analyzed to identify stakeholders and argumentations in the Dutch discussions about IAPS and health.

A stakeholder network was visualized. Three classes of concerns were discerned: concerns related to health risks, concerns related to the activity causing the risks and concerns related to the process to control the risks. The concepts of 'trust' and 'scientific uncertainty' were important themes in the current discussions. Concerns directly related to health risks and other concerns are currently intertwined, confusing public health decision-making. Given the divergent classes of concerns identified in the discourse, we argue that further explicit assessment of societal concerns and risk perception of stakeholders can positively contribute to the debate and governance of health risks related to IAPS in the Netherlands. Main recommendations include: differentiation of concerns in the discussions and communication about IAPS, development of a shared research agenda by public and private risk governors and validation of frameworks to assess stakeholder concerns.

### **Social media in food safety communication: experts and consumers perceptions**

*Natalia Lozano, Monica Lores, Jordi Farré (Universitat Rovira i Virgili)*

■ In the recent years, interest in food risk communication has dramatically increased. The main reason is the need to manage the several food crises and scandals that have occurred in Europe since the mad cow disease in the mid-90s. By this, institutions aim to recover citizens' trust. On the other side, the emergence of Social Media and Web 2.0 has incorporated the opinions of users into the public sphere. This has revolutionised communication in general and have obliged institutions and companies to rethink their communicative logics. The purpose of this paper is to compare experts and consumers perception about the opportunities and weaknesses of social media channels when disseminating information of food safety. In-depth interviews were used as methodology. A total of 99 consumers and 33 information supplier experts from five different European countries (Belgium, Ireland, Italy, Netherlands and Spain) have participated on this research. The results of this research show that now the use of social media by public food agencies mean uncertain opportunities. Lack of consumers' interest on food safety and the inability of maintenance of the social media platforms by food agencies have increased the complexity of recovering citizens' trust. This paper has been funded by the European Union within the Seventh Framework Programme (FP7/2007–2013) under grant agreement n° 245124.

### Gender differences in lay people and experts concerning their decisions about different strategies to fight epidemics

Alexandra Zingg, Michael Siegrist (ETH Zurich)

■ There is an ongoing debate about the difference between men and women concerning their risk perception and their decision behavior in risky situations. We asked a randomly selected sample of the Swiss population and a group of experts about their decisions to accept different strategies to fight epidemics. Past research suggests that experts tend to rate risks within their own domain as lower compared to ratings by the public and we wanted to know whether gender differences can be found in lay people samples and in expert samples concerning their decisions about strategies to fight animal epidemics. Data was gathered conducting a mail survey in the German and French-speaking parts of Switzerland. The response rate was 41% (N = 1123) for the population and 67% (N = 504) for the experts. Congruent with most antecedent studies, we found experts to differ significantly in their risk ratings from the lay people. Experts would decide to implement a certain strategy more often than lay people. We found gender differences in the lay people and in the expert samples. Therefore, we can clearly rule out the knowledge hypothesis for gender differences, as more knowledge does not override the difference between men and women in the expert sample. Gender differences remain even in areas where men and women have the very same knowledge, competencies and involvement. We included moral value questions in our analyses and we found gender differences for lay people and for experts. We see the differences between men and women in their different thinking about the world and we consider female experts' values to play a significant role in the decision-making process on societal risk policies. Implications for decision-making and epidemic situations will be discussed.

## T9 Symposium: Health literacy and empowerment I

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Chair: Ana Maria Moreno Londono (University of Lugano)

Health literacy mainly focuses on patient education and can influence peoples' health status and also their perception of health risks. However, patients need to be able to access crucial information or to gain knowledge regarding their own health conditions in order to actively manage their disease. This allows patients to become psychologically and situationally empowered through self management. This view of empowerment highlights the need for a person to be able to use available information to make judgments and decisions. Health literacy and empowerment are therefore a promising dyad in managing health risks. On the basis of the model 'Patients' literacy, empowerment and behaviour' (Schulz 2011) the Symposium will highlight the importance of health literacy and empowerment under different, especially chronic health conditions. The proposed symposium will consist of six talks starting with a presentation about the EMPOWER project by M. Fiordelli: EMPOWER: Support of Patient Empowerment by an intelligent self-management pathway for patients suffering from Diabetes. This presentation will provide the main conceptual framework of functional health literacy and empowerment. A more specific insight into the operationalization and specification of the concept cancer literacy will be provided by N. Diviani: 'What should we know about cancer? Establishing a concept of cancer literacy'. A-L. Frisch examined the relationship between health literacy and psychological empowerment and will present 'Predictors, mediators and moderators of psychological empowerment: Results from a cross-sectional study with chronic low back pain patients in Switzerland'. One component of functional health literacy is peoples' judgment skills, the ability to decide in self-management situations. Therefore, a tool measuring peoples' judgment skills has been developed and validated under two chronic conditions. A. M. Moreno Londono will present: 'Do patient's judgment skills matter in the health literacy ambit?' Furthermore, A. Dubowicz will present: 'Sleepless risks. Decisions of insomnia patients'. The final talk will present a validation study of the S-TOFHLLA, a widely used tool measuring functional health literacy. Currently validated versions of the S-TOFHLLA only exist in English and Spanish. M. Connor will present: 'Functional Health Literacy in Switzerland – Validation of a German, Italian, and French Health Literacy Test'.

### **What should we know about cancer? Establishing a concept of Cancer Literacy.**

*Nicola Diviani (University of Lugano)*

■ It is often difficult for non-medical persons to be adequately informed about issues that are essential to their health. Consequently, we assume that people lack a deep understanding of cancer risk and other important aspects of the disease, which could be useful in taking fundamental health decisions. Our goal was to operationalize and to specify a concept of Cancer Literacy, i.e. to understand what knowledge, abilities and attitudes make a person cancer literate and how literate is the Italian-speaking Swiss population. To operationally define the concept a Delphi study in 3 rounds was conducted among a panel of Swiss cancer experts (N = 48). To assess the validity of the resulting concept and to gain first insights into the cancer literacy of the Ticino population a measuring instrument was developed and administered to a sample of the general population (N = 639) stratified for gender, age, and educational level. The result of the Delphi process is an operational definition of the concept of cancer literacy. The survey provided evidence for reliability and construct validity of the new concept, and highlighted some major deficiencies as regards cancer knowledge. For instance, more than 60% of the respondents are not aware of the relationship between overweight and cancer. Moreover, some significant knowledge differences among people with different educational levels were found: just to mention one, almost 20% of women belonging to the lower educational level vs. only 2% of highly educated women ( $p < .01$ ) had never heard of a Pap test. The study helped defining the most cancer illiterate segments of the population and produced information on the best ways to reach them in communication campaigns. It also contributed to finding out which aspects of cancer literacy are most in need of improvement. This will help designing effective communication campaigns that are specifically targeted to where the deficiencies are.

### **EMPOWER: support of patient empowerment by an intelligent self-management pathway for patients suffering from diabetes**

*Maddalena Fiordelli, Sarah Mantwill, Peter J. Schulz (Università della Svizzera Italiana)*

■ Patient empowerment and diabetes education has proven to be a fruitful dyad already for more than two decades. Empowerment-based interventions have an impact on behavioral, psychosocial, and biological outcomes. Many of these interventions in the field

of diabetes are focused on two main aspects: healthcare professional-patient relationships, and the development of ICTs for self-management.

The EMPOWER project is an ongoing three-years project in cooperation with institutions across five European countries which will bring these two aspects together. It aims to build a modular and standards-based patient empowerment framework to help patients with type 1 and type 2 diabetes to become effective self-managers.

Under the light of Nakamoto and Schulz' proposed model of patients' literacy, empowerment and behavior (2011), the specific objectives of the study are to provide patients with personalized pathways in line with individual needs, capabilities and preferences. With the usage of tailored action plans the project will introduce diabetes-relevant behavior into the daily life of patients. These plans will be developed in accordance with physicians' recommendations and the patients' long-term goals, as well as with collected patterns of daily living. In order to build a comprehensive system it will also interoperate with other personal health applications and provide an open-source PHR system.

The project will offer health care providers and patients the opportunity to develop disease management plans detached from mere health care settings. This will not only help to empower patients to contribute to their own healthcare but also to be in more control of their disease by being enabled to make informed decisions about their health.

EMPOWER will be evaluated as pilot applications in Germany and Turkey. The results will provide insights into how to design and conceptualize comprehensive empowerment-based frameworks in order to meet diabetes patients' needs.

### **Predictors, mediators and moderators of psychological empowerment: results from a cross-sectional study with chronic low back pain patients in Switzerland**

*Anne-Linda Frisch (Institute of Communication and Health), Peter J. Schulz (Institutes of Communication and Health)*

■ Health literacy is considered an empowering tool that enables chronically ill patients to actively take part in the management of their disease. However, empirical evidence for the link between health literacy and psychological empowerment is scarce.

We aimed to examine the relationship between health literacy and psychological empowerment by testing a model that includes health literacy as a partial mediator between intrapersonal factors, interpersonal factors and psychological empowerment for male and female patients separately, introducing gender as a moderator.

We conducted a cross-sectional study with 188 chronic low back pain patients from residential and ambulatory settings. Patients received a self-administered questionnaire including measures of health literacy, psychological empowerment, intrapersonal factors (e.g., years suffering from pain), interpersonal factors (e.g., perceived social support), and socio-demographics. Health literacy was operationalized as declarative and procedural knowledge about back pain. Psychological empowerment was measured with four sub-dimensions (meaning, competence, impact, and self-determination).

Using structural equation analysis, we found that for both male and female patients intra- and interpersonal factors predicted psychological empowerment more and above health literacy. While for male patients health literacy proved to be a significant mediator between educational attainment and competence as well as perceived tangible support and competence, no significant mediation of health literacy was evident for female patients. These results point towards health literacy and psychological empowerment as independent concepts.

The results of this study show that empirical evidence for the relationship between health literacy and patient empowerment is necessary to better understand self-management behavior of chronically ill patients and to provide health education and support in healthcare more effectively.

## T10 Industrial risks

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*Chair: Lars Bodsberg (Sintef)*

### **Use of virtual reality for anticipation and reduction of risks in process industry**

*Salman Nazir (Politecnico di Milano), Simone Colombo (Politecnico Di Milano), Davide Manca (Politecnico Di Milano)*

■ The advancement in technology, automation and mechanization has revolutionized the industrial sector and as well as the jobs of concerned operators. Process industry (including the oil and gas sector) are saturated with complex equipment, sensitive parameters, variables, precise flow rates and given set of conditions; fulfillment of those are necessary for smooth, continuous, profitable and most importantly hazard free processes. A

minor error or misunderstanding of the operator can put the whole process at higher levels of risk. This paper presents a methodology for the anticipation and possible reduction to the risk exposure. A replica of an industrial plant is developed within a virtual environment facilitated by 3D glasses for stereoscopic vision and 3D spatialized audio for higher immersivity. This arrangement is coupled with a process and accident simulator. A detailed and immersive 3D model of the plant allows the operators understanding the details of both equipment and operating conditions. Moreover, the added augmented virtual reality feature allows enhancing and improving the understanding and skill of operators by letting them know the process operating conditions that dynamically change with the plant section where they work. Various abnormal scenarios of industrial processes can be developed by means of this the virtual environment tool. The operators will be exposed to these scenarios in a virtual environment in order to observe and evaluate their reaction and handling of situation for the anticipation of risk and its possible reduction. A set of experiments are performed in a dedicated 3D demo room where the subjects to be trained and assessed are either bachelor or master degree students. They are given adequate training before running the experiments. The results produced by the training and assessing procedure allow validating the proposed methodology and opening new horizons for the risk anticipation as well training procedures for risk reduction. The authors are involved in developing both methods and algorithms to exploit the operator assessment in virtual environments for decision makers and also for the sake of recruitment of operator.

### **Environmental decision-making within the steel industry: the role of individuals' worries, knowledge and responsibility**

*Monika Filipsson, Stina Alriksson (Linnaeus University)*

■ Knowledge about different variables that affect decision-making is important in order to understand and evaluate the cognitive process of decision-making in a research context. The decision-making process is of great interest for individuals in order to help decision-makers and their co-workers make appropriate decisions and understand what lies behind the decision.

The Steel Eco Cycle is a research programme in cooperation between the Swedish steel industry, the Swedish Steel Producers' Association and Mistra, the Foundation for Strategic Environmental Research. Previous results within this programme indicated that envi-



ronmental factors connected to personal worries (for example toxic substances) concerned decision-makers in a proportionally greater way than environmental factors that were more distant to personal risk (for example the use of non-renewable energy and resources). This study aims, therefore, to evaluate different factors, such as worries, knowledge, economy and legislation, and their influence on environmental related decision-making. The study also aims to explore who the decision maker feels has the responsibility for environmental improvements within the steel industry.

The Q-sort methodology was applied to the study and preliminary results indicate that personal worries concerning environmental problems do not compare with the environmental issues the decision-maker holds as important for his or her steelworks. This could mean that worry does not play an important role in the decision-making process. Also, the respondents themselves indicated that personal worries are not important for their decision-making, while they find their own personal knowledge to be an important factor.

Responsibility for reducing the environmental load of the steelworks is placed especially on the top management while the respondents of the study hold the municipal/local politicians as least responsible.

### **From legal liability and environmental forensics to efficient enforcement when multiple sources of pollution: an example with urban planning and brownfield restoration**

*Jean-François David (Compagnie Nationale des Experts de Justice en Environnement)*

■ Urban planning is a driver to future use of former industrial estates. Those future uses are mainly devoted to housing, services, public amenities.

Presentation will tackle management of a multiple source of soil pollution i.e. a complex and generally old industrial history through a four pronged approach.

#### **1 Environmental health approach – Technical expertise**

Environmental health approach is a subject for multidisciplinary approach.

Hard sciences (geochemistry, dendrochronology) must be backed by soft sciences such as local history and sociology, to draft solutions.

#### **2 Selection of future land use and related projects**

Selection of future land use is an iterative process inside which environmental forensics will deliver its contribution to have matched political outcomes and environmental constraints.

#### **3 Financial assessment for contaminated soil restoration**

Real estate operations which convert industrial plants in housing or play ground have commonly a higher restoration cost than simple industrial re-use.

When an expropriation process deals with soil pollution, it leads commonly to a shift from “polluter pay” principle to “owner pay” legal decisions.

#### **4 Deciding who will bear the environmental burden**

When multiple sources of pollution may lead to difficult and lasting law cases presentation will suggest trails and methods to anticipate and avoid that pitfall.

### **Environmental risk acceptance criteria applied in the Norwegian petroleum industry**

*Lars Bodsberg, Stein Hauge, Solfrid Håbrekke, Tony Kråkenes (Sintef)*

■ The Norwegian authorities have set out very ambitious SHE goals for the petroleum industry, including goals for environmental risk reduction. Sintef has identified and evaluated the environmental risk acceptance criteria applied on the Norwegian Continental Shelf. Focus has been on non-planned acute releases to sea and the barriers applied during drilling, workover and subsea production in order to prevent such releases. Today, the environmental risk analyses focus on the modeling of the consequences from accidental releases of oil/condensate. The analyses normally start with a set of release scenarios, and model the consequences of a release with respect to restitution time of vulnerable resources. Although frequency reducing measures shall be given priority, the barriers prior to the release are generally not an explicit part of the environmental risk analyses. In general the estimated risk figures are far below the environmental risk acceptance criteria, indicating that the criteria are too relaxed. It appears that all companies operating in Norway use more or less the same criteria and to a limited degree tailor the criteria to their particular situation. The authorities’ intention of relating the criteria to the individual environmental resources and to consider the facilities in a larger context is therefore not properly implemented. Alternative or additional acceptance criteria are called for to establish a better connection between overall criteria and performance requirements to important barriers. Sintef suggests additional ways of expressing environmental acceptance criteria based on release frequencies and release volumes. The results achieved are part of an on-going joint industry project funded by the Norwegian Research Council and industry members of the PDS forum.



# T11 Symposium: Coping with the risk-regulation reflex

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*Chair: Frederic Boudier (Maastricht University)*

*Speakers: Ira Helsloot (Professor of Politics of Safety and Security, Radboud University; editor, Journal of Contingencies and Crisis Management), Jan van Tol (Manager of the Risk and Responsibility Programme in the Netherlands), Michel van Eeten (Professor of Public Administration, Delft University of Technology), Frederic Boudier (Assistant Professor, Department of Technology and Society Studies, Maastricht University), and Henry Rothstein (Senior Lecturer, King's College London, Geography Department)*

The symposium presents some of the findings of the Risk and Responsibility Programme in the Netherlands. The programme runs till the end of 2012 and aims at providing government and public administrators with a Cabinet vision and a few other tools to help the proportionality of government interventions regarding risk (including after incidents). In other words, tools to withstand the 'risk regulation reflex' – a term which was coined at the landmark conference 'Day of Risk' in May 2010.

The Programme defines the risk-regulation reflex as the mechanism whereby a notion of risk can result in interventions with a disproportionate balance between costs, benefits and side-effects whereby the responsibility for prevention or compensation is almost as a matter of fact regarded as a government task. Interventions can take many forms such as rules, standards, inspection and implementation measures.

Public commotion in response to risk and incidents is normal and democratic. A problem arises only when a particular risk or a major incident leads to measures which are disproportionate because of the resulting: high costs for government or society, negligible increase in safety, restricted freedom of choice and other values, unrealistic expectations of government, obstacles to innovation.

## **Mechanisms causing the risk-regulation reflex**

*Ira Helsloot (Radboud University)*

■ This presentation describes several mechanisms underlying the risk-regulation reflex. On the one hand there seems to be a misunderstanding of the intractable citizen which leads to the incorrect assumption of politicians as well as public servants that the public

want more safety measures at any cost. Some original research on this misunderstanding is presented here. On the other hand activist experts and public servants responsible for controlling a specific risk team up in emphasizing the importance of more safety measures. Several underlying mechanisms are discussed which show how difficult it is for (the Dutch) government to control the resulting ever increasing number of interventions.

## **The Risk and Responsibility Programme in the Netherlands**

*Jan van Tol (Ministry of the Interior and Kingdom Relations)*

■ This presentation describes the genesis, evolution and course of the interdepartmental Risk and Responsibility Programme, commissioned by the Dutch Ministry of the Interior and Kingdom Relations. The remit is mainly geared to developing a Cabinet vision on the role and responsibility of government in dealing with risk. To underpin this, the Programme has been seeking greater insight into issues such as the nature and scope of the risk-regulation reflex, risk acceptance among the population, and argumentation for public administrators based on values. There is a comparatively strong following in the Netherlands, resulting in contributions from many organisations. For instance the Scientific Council for Government Policy (report presented to Minister Piet Hein Donner last November) and the Council for Public Administration (report scheduled around the summer of 2012). The Programme is organising various external dialogues (with politicians, journalists, public administrators) and interdepartmental meetings. Finally, the good practices ('active ingredients') for civil service and public administration are brought together. The Programme's closing conference is held in October 2012 during the Week of Resilience.

## **Risk and other 'psychopathologies' of governance: exploring national varieties of risk governance in Europe**

*Henry Rothstein (King's College London, Department of Geography)*

■ In recent years, there has been considerable international focus on improving the way in which governments manage harms to human health, safety, the environment and wider social objectives. In that context, risk-based approaches to governance have been promoted as providing a universally applicable foundation for improving the quality, efficiency and rationality of governance across policy domains. Premised on the idea that governance cannot eliminate all adverse outcomes, these approaches provide a method

for establishing priorities and allocating scarce resources, whilst also providing an ex ante rationale for the limits of governance. Yet, cursory observations suggest that risk-based approaches have not met with similar success across countries. Based on a comparison of the UK, France and Germany, this paper sets out to map and explain these varied patterns of diffusion. In particular, the paper stresses that the diffusion of risk-based governance is dependent on the extent to which ex-ante rationalisations of the limits of governance are both acceptable, and – depending on transparency and accountability contexts – needed, within different institutional contexts. The paper argues that the diffusion of risk-based approaches to governance is intimately related to deeply embedded norms, values and institutional rationalities that shape and constrain how public authorities account for their failures or limits within different polities.

#### **The diva and fate. Can the voter be pleased with fatalism?**

*Michel van Eeten (Delft University), Frederic Boudier (Maastricht University)*

■ Many politicians and administrators think that citizens are 'spoiled divas', and the result is a government which reacts in a compulsive and exaggerated manner to incidents. Government officials and public administrators find it usually very hard to communicate risks in balanced terms. A more ideological approach to risk is often easier to accept, even to the effect of promising too much. Fatalism – accepting that bad things may happen despite rational efforts to reduce risks – is absent in the current debate: failure is more or less a taboo and it is not hard to understand why. A risk is the chance of suffering. Chance is hard to imagine, suffering all the more, and that is why suffering is dominant in the debate. If we want to break through this compulsive pattern, we must take political rationality seriously. In other words: are there political messages that can sell the fatalistic acceptance of certain risks? Can failure be envisaged and openly discussed? This presentation describes some avenues for government to add more credibility to the message that 100% safety cannot exist. Promising avenues include distinct efforts to maintain trust in the process through a stronger commitment to science and evidence as well as a more effective interaction between key societal actors.

## T12 Energy sources: risk perception and communication

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*Chair: Christina Demski (School of Psychology, Cardiff University)*

#### **Why do information providers try to conceal risky information?**

*Motoko Kosugi (Central Research Institute of Electric Power Industry)*

■ There is information asymmetry between information providers (governments or companies) and receivers (the public). Information providers have a great deal of information not available to the public, therefore the providers can manipulate information in order to maximize their own interests without the public's awareness. The public often suspects information manipulation based on the lack of information, and the public may become more cautious or distrusting (risk averse). In these circumstances, concealing risky information towards a cautious public is a rational choice for the providers, as long as the public is unaware of it. However, the public might learn of the concealed information eventually and they might lose trust in the providers and will behave even more cautiously than before. Therefore, in the long term, concealing risky information is not rational since the providers will need a long time to rebuild the trust of the public if the concealed information is made known.

This study demonstrates why information providers continually conceal risky information despite potentially damaging the provider in the long term. In an experiment, participants were divided into pairs of "providers" and "receivers," and they interacted repeatedly. The results of the experiment were as follows. (1) Information asymmetry possibly elicited risk aversion in receivers, and furthermore the providers' expectation of the degree of this risk aversion influenced the behavior of the providers. (2) Concealing risky information was beneficial as long as the receivers did not detect it, but once they knew the fact, they became more risk averse and decreased trust on the provider. The providers, however, continued to conceal risky information. These results suggest certain circumstances in which concealing risky information might benefit providers in the short term and could prevent damage caused by receiver's risk averse behavior in the long term.

### **Risk perception of climate change and choice of energy source January 2007 and after the Fukushima accident in March 2011**

*Midori Aoyagi (National Institute for Environmental Studies)*

■ After the GreatEast Japan Earthquake followed by the Fukushima No.1 nuclear power plant accident, Japan has to re-plan her energy policy both in short-term and long-term, and her policy against climate change as well. As of 12th of January 2012, only 6 plants out of 54 are in operation, but within four months, those 6 plants will also stop operation due to annual regular inspection. None of inspected facilities is restarted because of strong criticism by the public after March 11th. As nuclear power generation is the one of the keys for Japanese climate change mitigation policies, it has huge impacts on Japanese climate change policy. As of mid-July 2011, the ministry of the environment Japan announced that additional 20–30 million ton-C (approximately equivalent to 12~14% of 1990 emission level) will be emitted every year after 2011.

Those accidents have given opportunity for people in Japan to discuss about current and future energy choices. People overcame electric shortage of 2011 summer, and this experience also let people think about their everyday energy consumption.

We have been conducting a series of public opinion surveys in the context of climate change policies from the risk governance point of view. In this paper we used our 2008, 2011 and 2012 survey results, and analysed public preferences and support for national energy policies. Comparing 2008, 2011 and 2012 results, clearly trust in governance system for nuclear power plants decreased, and support for renewable energy sources such as solar, wind, and biomass increased. After the principle component analysis, respondents who are aware of “potential” consequences of climate change, such as damages of biodiversity, impacts of agricultural production, and extreme weather are divided into two groups, one is “accept nuclear” and another is “prefer renewable energy”. This means that the relationships among people’s recognition of climate change risk and energy choice seem to be constructed on more complicated context.

### **Education, gender and perception of dominant energy sources**

*Roh Pin Lee (TU Bergakademie Freiberg)*

■ Public acceptability plays a decisive role in the long-term future of any energy source. However, while experts tend to rely on quantitative and technical risk definitions, public individuals may perceive and interpret such information in quite different ways to what experts originally intended or expected.

Significant divergence between public and expert perceptions can have dire and costly consequences. As such, considerable research efforts have been directed toward investigating public energy risk perception. However, characteristics of perceivers themselves as important moderators of energy perceptions have been largely neglected. Moreover, the predominant one-dimensional focus on one energy source fails to address the reality where complex energy decisions involve trade-offs between viable energy alternatives.

To address these gaps, this study draws on insights from risk perception and decision-making literature to empirically examine education and gender as characteristics of perceivers in moderating perception of nuclear, fossil and regenerative energy sources by utilizing a controlled ex-ante survey approach with young adults.

Findings show that not only do young adults from engineering and business disciplines exhibit significantly different energy perceptions; considerable perceptual divergence is also observed between non-university and university young adults. Furthermore, when education is controlled, women consistently show higher level of concerns compared to men. Gender and education also appear to have an additive effect, with university engineering males perceiving lesser risks, especially from fossil and nuclear sources. Findings are suggestive of the decisive role of knowledge base obtained through tertiary education in shaping energy attitudes. An important implication is that energy experts may reach decisions based on different beliefs from the majority of the society by virtue of knowledge bases provided by their educational backgrounds.

## Public perceptions of energy security risks

*Christina Demski (School of Psychology, Cardiff University), Nick Pidgeon (School of Psychology, Cardiff University), Wouter Poortinga (School of Architecture, Cardiff University)*

■ Along with climate change and affordability, concerns about energy security are the key drivers behind proposals for major energy system change in the UK and numerous other countries. Energy security is a complex concept, largely because it encompasses causes and consequences (risks) as well as possible solutions to ensure a secure energy supply. This paper is particularly interested in public perception of energy security risks because, unlike climate change, we know very little about how the public thinks and feels about this aspect of sustainability and energy policy.

We explore what it means to examine public perceptions of energy security risks, and provide an example of measuring these quantitatively. Results of two surveys (Cardiff-based paper survey, N = 510; online UK survey, N = 490) using an “energy security scale” will be presented and discussed. These surveys had the wider aim of examining public attitudes towards energy technologies and climate change and therefore allow further analysis of how energy security concerns relate to other attitudes around energy and the environment.

From this analysis we discuss what further work would be useful for understanding public perceptions in more depth, particularly because many people are unfamiliar with the term itself but may have an implicit understanding of individual aspects (e.g. dependence on other countries). The current finding that energy security concern was relatively high suggests that any disruptions of supply would be deemed unacceptable, perhaps even over and above climate change concerns. In addition, members of the public might perceive very little responsibility and control over energy security. A second discussion point focuses on the further development of quantitative scales to measure these perceptions.

## T13 Food risk perception

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*Chair: Marijn Poortvliet (Wageningen University)*

### Self-perception of food related risks: a survey of Italian consumers

*Licia Ravarotto, Stefania Crovato, Giulia Mascarello, Laura Contalbrigo, Barbara Tiozzo (Istituto Zooprofilattico Sperimentale delle Venezie)*

■ Food safety is a focal point that food industries and regulatory agencies need to develop, and continues to be of great concern for consumers. The European legislation promotes a food safety policy which involves all steps of the food production chain: “from farm to fork”. In this process, consumers’ perception and behaviours have an important role in the spread of food born diseases. Adopting improper food habits, in the domestic scenario, could cause an increase in the level of exposure to risks. Given that consumers play an active role in food safety, the understanding of their social characteristics is crucial to address policy makers’ choices towards effective preventive actions. Consumers’ habits are also related to their knowledge. Literature (Eurobarometer 2010) suggests that people are poorly informed on the origin and management of food poisoning.

In this framework, a national survey was conducted to highlight people's exposure to food risks. A representative sample of Italian consumers was interviewed through the CATI method. The sample (N = 1000) consisted of people responsible for food purchasing in their households or for themselves, and was stratified by gender, age and geographical area. Data analysis allowed defining some consumer profiles starting from the self-perceived level of exposure. Factors that can influence consumers' self-perception of exposure to food risks (social habits, social condition, education, geographical position) were investigated in subgroups of consumers with high and low self-perception of risk exposure. Moreover people's self-perception of risk in connection with their knowledge of food risk issues was analysed.

The paper presents consumer profiles, especially comparing perceived risk and real risk. Data have a double advantage: on the one hand they provide information about the consumers' level of risk exposure, and on the other hand they show how knowledge of topics related to food safety can affect risk perception. These results will be provided to public health authorities and decision makers to promote the planning of effective communication activities and the development of true-life risk assessment systems.

### **Between fragmentation and segmentation: a relational model of consumers' food risk perceptions**

*Henrik Merckelsen, Gorm Gabrielsen (Copenhagen Business School)*

■ It is widely acknowledged that consumer risk perceptions of food risks differ not only from expert evaluations (cf. Knox 2000) but also within the heterogeneous group of lay people or 'average consumer' (e.g. Siegrist, Keller and Kiears 2006). The paper presents a model of consumer risk perceptions of everyday food products. As a theoretical point of departure the paper introduces a relational understanding of the risk concept and explains how risk is founded on an ontologically objective relation between objects with specific danger characteristics and objects with specific value characteristics (Boholm and Corvellec 2011; Merckelsen forthcoming). Then the paper presents data from a survey (N = 800) where a representative sample of Danish consumers rate 8 concrete food products on a 5-point Likert scale according to risks, benefits and control together with attitudes towards 6 value preferences.

Through multiple variation analysis the paper demonstrates how variations in consumer perceptions of food risks at aggregate level are formed by a combination of product (risk) characteristics and value preferences. When variations among and within individuals are included in the analysis a more nuanced pattern emerge which allow for a segmentation of consumer types with regard to food risks.

The benefit of the model proposed in this paper is that it enables risk managers to target risk mitigation initiatives (regulation, information, involvement etc.) very precisely. However, the model is less suitable for comparing dissimilar risks at aggregate level as it is usually done in traditional psychometric studies.

Finally the paper suggests that the model proposed in this paper as well as the underlying methods can be extended to meet the needs for practice oriented risk management tools in other empirical areas.

### **Risk and utility perceptions of new food technology – the added value of implicit measurement**

*Machiel Reinders, Amber Ronteltap (LEI, part of Wageningen UR)*

■ Societal response to new technologies has a large impact on the further development and level of acceptance of these technologies. Previous research is largely based on well-defined models that adhere to the rational actor assumption, i.e. the consumer as a rational being who is explicitly aware of his or her considerations. Implicit processes are hardly incorporated. However, when explicit and implicit processes lead to different outcomes, asymmetric effects can occur. Knowledge on implicit processes has been advanced by the development of so-called implicit measures, most of which are based on computer-based, speeded categorisation tasks. These implicit measures differ from explicit measures employed to assess conscious beliefs, which are based on self-report or survey methodology. In this study, we made a first effort to translate this knowledge into an applied tool in the area of nutrigenomics, a new food science area. We investigated the differential effect of implicit and explicit measures of risk and utility perceptions on consumers' attitude towards nutrigenomics. A single category implicit association test (SC-IAT) was developed, with pictures and words related to nutrigenomics as the attitude object. The results show that the implicit measure of risk perceptions was a significant predictor of attitude, whereas the explicit measure of risk perceptions was not. Also, the implicit measure of utility perceptions did not significantly predict attitude, whereas the explicit measure of utility perceptions did. Indeed, the rational actor assumption alone appeared to be inadequate in explaining consumer response to new technologies, particularly in the case of more affective predictors such as risk perceptions. Measuring implicit associations related to new technology seem to be a promising avenue for increasing predictive validity of consumer response models.

### **Predicting intentions to use novel biotechnologies: the role of risk perception, trust, knowledge, and social norms**

*Marijn Poortvliet, Marijn De Bruin, Bob Mulder (Wageningen University)*

■ According to some, the 21<sup>st</sup> century will be the age of biotechnology. Indeed, the pace in which new biotechnologies become available is enormous and these technologies will potentially have big consequences for daily life – if they are implemented. Moreover, biotechnology spans a wide area of applications: medical (e.g., new antibiotics), food (e.g.,

genetically modified animals) to name just a couple. However, whether these technologies will be adopted and thus will prove successful may depend critically on risk-relevant psychological processes. In order to test for the factors that predict intentions of adopting novel biotechnologies, a survey was held among members of the Dutch public (N = 737). Either a biotechnology – that was not yet available but might become available in the near future – in the medical or in the food domain was described and participants were asked to report how likely they were to use this particular technology. Furthermore, ratings of risk perception, benefits, dread, social norms, and trust attached to the particular technology were assessed as well as participants' level of knowledge of the technology. Finally, relevant demographic variables were measured. A structural equation model suggested – across both the medical and food domain – that risk perceptions, trust in stakeholders and knowledge of the technology predict intentions to use the technology. Furthermore, these relationships are fully mediated by social norms and usefulness attached to the technology. Additionally, it was found that religiousness negatively predicted intentions to use the medical technologies, a relationship that was not observed with food technologies. These results are compared in relation to existing theories and models (e.g., theory of reasoned action, affect heuristic) and implications for theory and research in the risk domain are discussed.

## T14 Symposium: Health literacy and empowerment II

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*Chair: Anne-Linda Frisch (Institute of Communication and Health)*

### **Do patient's judgment skills matter in the health literacy ambit?**

*Ana Maria Moreno Londono, Peter J. Schulz (University of Lugano)*

■ Chronic asthma patients self-manage their health condition on daily basis out of the clinical setting. This implies having the skills and understanding to use their medicines adequately, avoiding triggers, and recognizing symptoms, this entails being health literate. Patients require to exert their own judgments on deciding how to proceed in common and new situations, and this type of judgments are partly motivated by the patient own life-

style and goals, denoting that self-management is dependent on the individual's subjective experience. According to the literature is essential to consider the patient's judgment to obtain more effective and positive outcomes on the self-management practices. Departing from the Health Empowerment Model (Schulz & Nakamoto, 2005), this study will present the development and validation of a tool to assess the judgment skills construct, built on self-management situations experienced by asthma patients. The developed tool was constructed using the situational judgment test format, 19 scenarios with 4 response-options each were made. A review of scientific literature on asthma self-management, a focus group, and several interviews with pulmonologist and asthma patients were carried out. Furthermore, The validation of this tool was conducted using the Delphi methodology, with the involvement of 10 pulmonologist. Face and content validity were achieved by face-to-face interviews with 1 pulmonologist and 5 patients. Two rounds of the Delphi procedure were necessary to achieve consensus among the specialist on the adequacy and accuracy of the scenarios' topics and response-options. The scores computed are the average evaluation given by the experts to each of the response-options, and represent the adequacy of each of the judgments from the medical point-of-view. This tool will have a final score representing patient's judgment based on the specialist consensus, and its impact on health literacy, empowerment and some self-management outcomes will be further analyzed.

### **Sleepless risks. Decisions of insomnia patients**

*Arthur Dubowicz (Università della Svizzera italiana)*

■ Research findings demonstrate that positive health outcomes of patients are strongly related to the concepts of health literacy and empowerment (Parker 2000; DeWalt, Berkman, Sheridan, Lohr & Pignone 2004). As insomnia is a major problem in our society and because this disease requires self-care skills beside professional treatment, patients have to take decisions which have an impact on their health outcomes, without medical consultation.

Based on findings from the literature and a patient-centered model proposed by Schulz and Nakamoto (2011), an instrument for measuring patients' judgment skills, a notion in order to capture their decision, in the context of insomnia was designed. The instrument contains scenarios with different relevant situations for insomnia patients.



Starting with a search for relevant literature typical problems were identified and transformed into situations. First evidence for the relevance, clearness, and appropriateness of the given situations were tested with a focus group of patients and further questions were clarified in interviews with patients and doctors. Medical advice from sleep experts was incorporated into the whole process of instrument development and relevant aspects of the local health care system were respected. Each scenario was followed by four answer options which were rated by health professionals in an online-assisted Delphi study with respect to their helpfulness for a positive health outcome.

This process of consensus building among doctors shows which answering possibility is considered to be the best for a positive health outcome from a medical point of view and which one is inadequate or risky. So scenarios with a strong overall agreement can be identified. With respect to the relationship between the doctor and the patient, risky to beneficial patient behavior for the individual health outcome and further knowledge about patients' self-care decisions can be identified.

#### **Functional health literacy in Switzerland – validation of a German, Italian, and French health literacy test**

*Melanie Connor (Institute of Communication and Health), Sarah Mantwill (Università della Svizzera italiana), Peter J. Schulz (Università della Svizzera italiana)*

■ Numerous studies have shown that health literacy can influence peoples' health status and therefore also their perception of health risks. In Switzerland the healthcare system operates in three different languages; German, Italian, and French. However, currently validated tools measuring peoples' health literacy only exist in English. The aim of the present study was to validate Swiss versions of the Short-Test of Functional Health Literacy (S-TOFHLA), which have been directly translated into German, Italian, and French. Therefore, the original English version of the S-TOFHLA was translated into German, Italian, and French applying standardised translation methods and cultural adaptations. 659 'Face-to-Face' interviews were conducted using the standardised procedure for the English S-TOFHLA; 249 with German speaking, 273 with Italian speaking, and 137 with French speaking Swiss inhabitants. Results show that Swiss-Germans possess a very high level of health literacy (93%), followed by Swiss-French (83%) and Swiss-Italians (67%). For all three versions, the health literacy scale categorised participants into three levels of health literacy with most people possessing either low or high health literacy levels. Only a small

percentage of respondents had marginal health literacy. Older people and people with lower levels of education had significantly lower levels of health literacy. Furthermore, the translated versions of the S-TOFHLA appear to be a valid measure of health literacy and can be used to assess health literacy in German, Italian, and French.

## **T15 The impact of natural hazards: flood risks and tsunamis**

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*Chair: Florent Pratlong (Université Paris 1 Panthéon-Sorbonne)*

#### **The case of London: dealing with complex urban systems and evacuation of public in case of flooding**

*Funda Atun (Politecnico di Milano)*

■ When a complex city system is struck by a hazard, it stops operating as in normal conditions due to interrupted connections among elements. Vulnerability analysis could show us which elements are vulnerable to disasters and how they can be affected by hazards; however, how interaction affects the number of variables and consequently the number of dimensions cannot be foreseen before its occurrence. Furthermore, one cannot be sure the reaction of humans, whether they follow orders and/or join the evacuation process properly. London is a good example to a complex city system by being the largest urban zone in European Union and being prone to flood hazard. Although the construction of Thames Barrier protects the city from tidal flooding, the risk of flooding still exists mainly due to changing vulnerability and hazard characteristics. The social and physical vulnerability have changed as people feel in secure and development rate has increased along the Thames River after the construction of the Thames Barrier in 80s. This paper starts with a social and physical vulnerability analysis in London and reveals the difficulties of managing disasters in complex city system by focusing on transportation system and evacuation procedures. This paper covers "disaster risk management", "complexity science" and "transportation system" research areas within a theoretical framework that enables the researcher to adopt a methodology to solve the critical problems of the transportation system in case of natural disaster by focusing on evacuation process. The data



gathered from interviews to public and to experts from various organizations, and from reports of various institutions, organizations are analyzed to give a general framework about the situation in the case study area in terms of identification of possible structural, functional and organizational failures during an emergency mainly by focusing on the London Borough of Lewisham and Lewisham University Hospital which is located directly in a flood zone.

### **Understanding flood risk perception in the Netherlands and its implications for self-protective action**

*Herman Van der Most (Deltares), Teun Terpstra (HKV Lijn in Water), Jan Gutteling (University of Twente)*

■ Perception of flood risk in The Netherlands is generally low and so is the intention to engage in self-protective behaviour. Government policy is to raise flood awareness to promote self-reliance of the population in the flood prone areas. The assumption is that elevated levels of risk awareness will help to stimulate pro-active self-protective action. Within this framework the impact of risk messages on citizen's flood risk perception was studied in two field-experiments.

In the first study an online field experiment was conducted in three Dutch regions (Zeeland, Isle of Dordrecht, and Maaskant) with different exposure levels to floods due to different flood protection standards. A 2 (high versus low risk perception) x 2 (high versus low perceived efficacy) x 3 (region) between-subjects design was used to study the impact of the information on flood risk perception and the intention to self-protective behaviour. Results showed that, compared to low levels of risk perception, high levels of risk perception led to higher levels of individuals seeking risk information with the intention to engage in self-protective behaviour. All simple effects indicated an increase in information seeking with approximately 20%.

The second study looked into the impact of risk perception on more specific behaviour of citizens with respect to buying insurances, housing preferences and a number of other self-protective measures. The study distinguished between people living in areas protected by embankments and people living in so-called flood plains. The participants were confronted with a risk message that included a specific risk frame within the 'story' on flood risk for the respective areas. The study shows a clear impact of the risk frame adopt-

ed. The frame with little or none communication showed a much lower intention to engage in self-protective measures than the other frames.

The two experimental studies vary with respect to the approach adopted and the exposure level to floods. Nevertheless there are similarities in the outcomes of both studies. An effort is being made to make a synthesis of the insights gained from both studies. The results of this synthesis and the implications for flood risk communication will be discussed.

### **How do we perceive tsunamis in French Islands? The case of The Reunion Island**

*Florent Pratlong, Sophie Gaultier-Gaillard (Université Paris 1 Panthéon-Sorbonne)*

■ The Reunion Island is undoubtedly a textbook case study because among the seven categories of major risks it harbours: hurricanes, vulcanoes, floods, landslides, forest fires, and huge swells...Tsunamis are not considered in France as a major risk because the majority of our territories can't be impacted, so this risk is completely ignored by the authorities. Nevertheless in the Reunion Island we have discovered that in 1883, a 30 meter high Tsunami reached the coasts and if it occurred today it would have an impact on 100 000 local residents in St Paul. From an economic point of view we have studied this risk in order to evaluate its social and economic impact to be able to better understand the revealed preferences of the inhabitants of this island, and also to help the authorities to deal with it and decide whether or not they have to take it into account as a major risk. We have used contingent valuations on a sample of 348 questionnaires collected in different sites of the island. We have collected five types of information: firstly, the way of using that space and the practised activities, secondly, the degree of the tsunami consciousness-raising of the individuals, thirdly, the individual apprehension of the of the vulnerability of such a tsunami risk, fourthly, the valuation of a protection against tsunamis, fifthly, the socio-economic data to better understand the motivations of the inhabitants. Two different kinds of payments are proposed to the individuals: an insurance or a voluntary contribution to borough-council facilities. The mean amount that each individual is ready to pay, is around 2,25 euros a year. It shows that the local residents do not feel involved in this risk while the insurers are becoming more and more interested in it because every year, small tsunamis cost them quite a lot of money. The gap between those two approaches is worth studying.

# T16 Symposium: Future infrastructures for meeting energy demands – Helmholtz Alliance Energy-Trans

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*Chair: Pia-Johanna Schweizer (University of Stuttgart)*

The energy sector faces major challenges. The accelerated nuclear phase-out and the problem of climate change which calls for considerable reductions in CO<sub>2</sub> emissions are but a few of the most pressing energy policy issues demanding urgent attention.

The Helmholtz Alliance Energy-Trans offers a novel approach to the solution of these problems. The research alliance conceptualizes the energy system not only from the supply side, but also from the side of societal demand and the end users' point of view. The alliance brings the interrelationship of the organizational, economic, social and cultural context of energy infrastructures into focus, thereby bridging disciplinary boundaries between the natural, technical and social sciences. The main objective of the Helmholtz Alliance Energy-Trans is to investigate these various interfaces between technical, environmental, organizational, psychological and social issues. The alliance is expected to provide policy-oriented knowledge for the design of efficient and socially acceptable energy infrastructures. For further information please visit [http://www.helmholtz.de/en/joint\\_initiative\\_for\\_innovation\\_and\\_research/initiating\\_and\\_networking/helmholtz\\_alliances/energy\\_trans](http://www.helmholtz.de/en/joint_initiative_for_innovation_and_research/initiating_and_networking/helmholtz_alliances/energy_trans).

The symposium "Future infrastructures for meeting energy demands – Helmholtz Alliance Energy-Trans" will present the research alliance and the thematic focus of the research fields, paying special attention to the co-development of technology and its social context. The symposium will include the following presentations:

- Technological-Societal Development: Witold-Roger Poganietz
- Innovation Processes and the Transformation of the Energy System: Gerhard Fuchs
- Risk and Regulation: Carsten Orwat
- User Behavior: Birgit Mack
- Planning Governance: Pia-Johanna Schweizer

The symposium will be introduced by Ortwin Renn and commented by Nicholas Pidgeon.

## Technical-societal development

*Witold-Roger Poganietz (Karlsruhe Institute of Technology)*

■ It is widely acknowledged that technological progress is a necessary but not a sufficient requirement for a transition to a sustainable energy system. Non-technological factors, like habits and expectations of relevant stakeholder (consumer, politicians, etc.) are crucial for successful innovation. The term co-evolution is used to describe this mutual relationship between the socio-economic environment and the development of innovative technologies for an energy transition.

However, the knowledge of the relevant technologies resp. the possible future technology mixtures is crucial to explore the interfaces between the future technological developments and the users on the demand side with the potentials and risks of these technology options. The precise understanding of co-evolution could be seen as a pre-condition for a successful transformation process.

Technologies are not developed in an isolated world. The transformation of the energy system and thus the one of the technological base takes place on different activity levels and is an outcome "of multi-dimensional interactions" within the society. These different scales are the setting of the goal and scope of the research field "Technical-Societal Development".

The four projects will serve the different activity levels:

- Technology-Infrastructure transition
- Scenarios
- Regional Modelling
- External perspectives and EU-Integration

The overarching aim of this research field is to analyze the contribution of technology-infrastructures to the transformation of the German energy system in different scenarios and their impacts on the development in selected regions however taking into account the integration of Germany into the European and global economical and political system. In the frame of the research field society is not seen just as an exogenous goal setter but as an integrated part of the transformation process and thus of the research.

### **Innovation and insecurity: transforming the energy system in Germany**

*Gerhard Fuchs, Nele Hinderer, Mario Neukirch (University of Stuttgart)*

■ The energy sector is traditionally dominated by a few closely related actors (energy suppliers, builders of power stations). The increasing importance of renewable energies in the energy mix in Germany will considerably challenge these established structures. While the traditional form of power generation and supply is based on centralized structures with large-scale power plants, the objective of a strongly decentralized form of energy supply is now more and more coming to the fore. This requires not only new impulses for existing innovation networks but also adaptation processes for the relevant actors of the value-added chain. These processes need to be supported by new institutions and regulatory mechanisms. Decisions have to be made under a high degree of uncertainty and risk, which nevertheless are aimed at bringing about rather quickly a new equilibrium situation. The analytic approach taken is informed by the Theory of Strategic Action Fields.

### **Systemic risks in the electric power infrastructure?**

*Carsten Orwat (Karlsruhe Institute of Technology)*

■ As envisaged by developers, economic actors or politicians, advanced information and communication technologies (ICT) should be utilized in electricity infrastructures to an unprecedented level, mainly to enhance the capability to handle the more volatile power supply by renewable energy sources. However, the extended use of ICT can also be a source of additional risks, due to the increased 'openness' of the ICT-intensive infrastructure, increased complexities, interdependencies or system-wide failures, potential failures of ever more complex governance structures, or incoherent technical and governance developments. The question is raised whether systemic risks may emerge in the electricity sector, and which research perspectives may then be useful.

### **User behavior**

*Birgit Mack (University of Stuttgart)*

■ Private households and industry combined account for more than 50% of energy consumption in Germany. Therefore, both target groups are investigated in the research field "User Behavior". Energy infrastructure is changing, with smart grids enabling fine tuning of demand and supply, smart meters making patterns of energy consumption visible for end users, and cars serving the function of interim energy stores.

Private households will have a much more active role to play. They should be aware of the challenges of a sustainable energy supply, reduce their level of consumption, and be prepared to time-shift their everyday routines. Because there is insufficient knowledge about the willingness of users to accept or even support such behavioral changes, in-depth research is needed.

With regard to the sector of trade and industry, there is a lack of knowledge concerning determinants of energy efficiency improvements and also concerning the obstacles and potentials of adapting to the contingencies of renewable energy supply.

In the research field "User Behavior" three research projects will be conducted:

- Project 1: Determinants of household decisions and behavior (coordinated by University of Magdeburg)
- Project 2: Determinants of industrial decisions and behavior (coordinated by ZEW)
- Project 3: Effectiveness and efficiency of interventions (coordinated by ZIRN)

The focus of this presentation is on private households and their decisions and behaviors relevant for energy consumption. ZIRN will be involved in project 1 with a subproject about rebound-effects. The project analyses rebound-effects in the context of buying and using hybrid and e-cars. A subproject of project 3, conducted by ZIRN, investigates the effectiveness of smart metering. A website connected to the smart meter which combines information and feedback supporting energy efficient behaviors will be developed and evaluated in a longitudinal study.

## Planning governance

*Pia-Johanna Schweizer (University of Stuttgart)*

■ The transformations in the energy sector will invariably spark societal debates if not controversies. Debatable issues are questions of equity, such as how (financial) burdens should be allocated across society, resolution of conflicts regarding values, and diverging societal preferences. The research field “Planning Governance” within the Helmholtz Alliance Energy-Trans will deal with these issues, trying to answer the question of how to come to competent and socially acceptable decisions about controversial topics.

Despite many research efforts and innovative contributions to risk governance and planning governance, there are still gaps in our knowledge concerning the question of how to do public participation well. The research field will address these knowledge gaps and contribute to the theory and practice of public participation.

The research field “Planning Governance” consists of three research projects:

- Analyzing conflicts in planning processes: coordinated by Prof. Gregor Betz, KIT (LOB-STER)
- Potential and limits of discursive approaches: coordinated by Dr. Pia-Johanna Schweizer, ZIRN
- Due process in energy infrastructure planning: coordinated by Prof. Wolfgang Köck, UFZ

Each of these research projects contributes important aspects to the improvement of policy making in the energy sector. The project “Analyzing conflicts in planning processes” investigates societal controversies and debates. The project analyses societal change and its reflections as social discourses. The project “Potential and limits of discursive approaches” will explore and experimentally test the prospects and limits of deliberative, group-based approaches in various online and offline formats. The project “Due process in energy infrastructure planning” will tackle the question whether the current framework of planning law is sufficient to come to adequate decisions while balancing heterogeneous interests.

# WEDNESDAY 20<sup>TH</sup> JUNE

## W1 Symposium: Nuclear power after Fukushima

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*Chair: Vivianne H. M. Visschers (ETH Zurich, Institute for Environmental Decisions)*

Major nuclear accidents, such as the recent accident in Fukushima, Japan, have been shown to affect the public’s perception of nuclear power. However, since the previous major nuclear accident, several things have changed, e.g., regarding technological innovation, energy demands and environmental issues. These changes may have influenced laypeople’s reactions to a nuclear accident and their perception of nuclear power. In short, a thorough examination and discussion of the influence of the recent nuclear accident on the general population is worthwhile.

In this symposium, we intend to give an overview of studies on the public’s perception of nuclear power after Fukushima, conducted in Europe. Moreover, we aim to show to what extent this perception was changed due to the nuclear accident. First, Verena Klusmann shows that the question format largely determines the amount of change in perceived risk of nuclear power, especially in comparison to other health risks. Next, Michael Rudolf focuses on people’s preference for nuclear power and alternative energy sources before and after the Fukushima accident. Vivianne Visschers then presents the results of a longitudinal study on the Swiss public’s view of nuclear power before and after Fukushima. Last, Nicholas Pidgeon considers the situation in Britain regarding public perception and policy responses. The presenters will discuss the implications of their findings for the communication and management of nuclear power facilities, as well as for energy policy

### **Now you see the panic, now you don't: general and personal risk perceptions in German laypersons before and after the Fukushima nuclear accident**

*Verena Klusmann, Katja Neumann, Britta Renner (University of Konstanz)*

■ Risk perceptions are examined from two core perspectives: For assessing general risk perceptions, laypersons' are asked to compare the riskiness of different hazards (e.g., nuclear power vs. hydropower) and for assessing personal risk perceptions, they are asked to estimate the risk for a specific person (e.g., a peer). In the present study, these fundamental different perspectives are compared and changes in risk estimations after the Fukushima accident were assessed.

A first online survey was conducted in 2010 (N = 550) and a second one two weeks after the Fukushima accident in 2011 (N = 1094). In both studies, participants were asked to select today's five biggest risks for health and to rate the likelihood of health problems due to the hazards for an average peer.

Prior to the Fukushima accident, nuclear energy was rated as being the sixth biggest health risk, but after the accident it was rated as being the third biggest risk,  $\chi^2(1) = 39.38$ ,  $p2 = .01$ .

Thus, a heightened risk perception regarding nuclear energy after the Fukushima accident was most pronounced when taking an across hazard perspective, but diminished when people took an across person perspective. Also, the overemphasis of technological risks can be put into perspective when people base their judgments on a more concrete, person-related framework, suggesting that certain ways to ask questions erroneously facilitate the "mass panic" phenomenon blanced by the media.

### **Public preference changes of electricity options following Fukushima**

*Michael Rudolf (ETH Zurich)*

■ The major nuclear accident in Fukushima in spring 2011 led to renewed protests against nuclear power in several European countries and both Germany and Switzerland opting to phase out nuclear technology. To ensure future electricity supply security, such a phase-out however requires more than a consensus against nuclear power – it also requires an equally strong commitment of decision makers and the public at large to accept and actively promote alternative energy sources. The question is therefore not only how the nuclear accident affected laypeople's preference of nuclear power but also how it affected preferences of the alternatives.

An online experiment was conducted in February (N = 69) and repeated in June 2011 (N = 57) in two identical samples from the same Swiss target population, applying the same questionnaire. The experiment included a conjoint measure with 11 choice sets. The choice sets applied the attributes production technologies (nuclear, gas and photovoltaics (PV)), price instruments and strategies (increasing production, reducing consumption and imports). It also included direct rating questions on preference for nuclear, gas, PV, wind and hydropower.

The results showed preference for nuclear power dropping significantly after Fukushima. Preference for all other production technologies however did not change significantly. The results further showed that even in a scenario where implemented renewable energies proved insufficient to satisfy demand, respondents remained unwilling to accept non-renewable alternatives or (policy) measures that further supported realization of renewables. In particular the necessary midterm 'stepping stones' of gas and imports on the way towards renewables remained unpopular. These results suggest, that social acceptance remains a challenge for future electricity supply security as the public does not yet consider nuclear phase-out, promotion of renewables and the measures required to achieving this transition jointly.

### **Results of a longitudinal survey on the Swiss public's perception of nuclear power before and after Fukushima**

*Vivianne H. M. Visschers, Michael Siegrist (ETH Zurich, Institute for Environmental Decisions)*

■ In the past, major nuclear accidents have reduced laypeople's acceptance of nuclear power. The nuclear accident in Fukushima, Japan, may therefore have similar effects on the public. Only few studies have however investigated the public's perception of nuclear power in a longitudinal design. Moreover, little is known on the extent to which a nuclear accident can change the relation between acceptance, risk and benefit perceptions, and social trust regarding nuclear power.

We conducted a longitudinal mail survey among a representative sample of the Swiss population (N = 453). Wave 1 was six months before the nuclear accident in Fukushima, Wave 2 two weeks after the accident in Fukushima and Wave 3 took place six months after the accident. The questionnaire included items on acceptance, perceived risks and perceived benefits related to nuclear power stations, and trust in stakeholders. Directly after the nuclear accident, respondents' levels of acceptance, benefit perceptions and

trust were significantly lower, and risk perception significantly higher than before the accident. Six months after the nuclear accident, the public's opinion of nuclear power already seemed more similar to that before the accident.

By means of structural equation modeling, we tested a model to explain people's acceptance of nuclear power. As hypothesized, benefit perception had most impact on acceptance in all three waves, whereas the influence of risk perception appeared small to negligible at Waves 1 and 3, but to have increased directly after the nuclear accident. Trust influenced both risk and benefit perception in all three waves.

Thus, the influence of the nuclear accident seemed on the public's perception of nuclear power appeared relatively small and not to last long. Our results suggest that even after a serious accident, a discussion of a technology's benefits is more likely to affect the public's acceptance of nuclear power than a discussion of the risks.

#### **Nuclear power in Britain after Fukushima: a case of risk attenuation?**

*Nick Pidgeon (Cardiff University)*

■ This paper reflects upon the very different public and policy reactions to the Fukushima disaster that have occurred in Britain when compared to the responses in some other European countries. Drawing upon nationally representative quantitative tracking evidence we show how overall support for nuclear power in Britain had, some 6–9 months after the events in Japan, returned to the levels seen before the accident. These results are discussed in relation to; (a) our theoretical understanding of how attitudes to nuclear power risks and benefits had developed in the UK over the previous 10 years, where energy security and climate change concerns have become prominent in the public debate about energy futures; (b) other factors which might have attenuated the risk for people in Britain, such as spatial distance and media representations; and (c) the particular energy policy context existing currently in Britain, with the government now committed to a renewal of the nuclear sector as part of its long-term energy strategy. The paper concludes with a brief discussion of the ambivalences and contradictions that are likely to remain with public acceptance of nuclear power risks in Britain.

## W2 Symposium: The making of common sense

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*Chair: Helene Joffe (UCL)*

The symposium explores issues that cut across a diverse set of risks using social representations theory as a tool for analysing the uptake of risks in lay populations. The theory elaborates the making of common sense out of novel risks, and, in particular, how antinomies often frame common sense (e.g. in climate change thinking, the tension between whether it is human-made versus natural, between certainty and uncertainty and between whether it affects self or others). In addition, cutting across the 'common sense' made of many contemporary risks is 'upward' blame and concomitant distrust of certain authorities and institutions, which replaces the downward blame of the past. This is seen in infectious disease regarding institutions such as the WHO, in climate change regarding climate scientists and in certain culture's representations of earthquake damage as caused by corrupt building practices. The symposium explores the theoretical implications of these commonalities for the study of risk, as well as elucidating the more unique aspects of the common sense made of each of the four risks.

The symposium leader is Helene Joffe (UCL) and the talks are 'Social Representations of Earthquakes: A Study of People Living in Three Highly Seismic Areas' (Helene Joffe & Tiziana Rossetto, UCL); 'How the public engages with global warming: A social representations approach' (Nick Smith, Yale & Helene Joffe, UCL), 'Making (common) sense of the risk of new infectious diseases' (Peter Washer, Queen Mary) and 'Risk and the brain: How the media represents risks to brain health' (Clíodhna O'Connor, UCL).

#### **Social representations of earthquakes: a study of people living in three highly seismic areas**

*Helene Joffe, Tiziana Rossetto (UCL)*

■ Much research on people's seismic adjustment activity in highly seismic areas has assumed that low levels of adjustment are attributable to insufficient awareness of seismic risk. Empirical evidence for this assumption is weak, and there is growing appreciation of the role played by socio-cultural and emotional variables in risk perception and behaviour. This study explores this socio-cultural and emotional dimension via 144 interviews

and questionnaires with matched samples of locals in three highly seismic areas: Seattle (USA), Izmir (Turkey) and Osaka (Japan). The data demonstrates that high awareness of seismic adjustment measures is not translated into behaviour, with all sites demonstrating low adjustment uptake, though the North Americans adopt significantly more adjustments than the other cultures. Qualitative analysis suggests that adjustment behaviour is undermined by anxiety, distrust, distancing self from earthquake risk and fatalistic beliefs. Each culture's representations of the risks are characterised by certain tensions, such as that between the earthquake as an 'act of God' and attempts to predict and mitigate the effects of earthquakes in Turkey, and that between optimism and fatalism in the US. Such tensions are explored, as are issues of blame and trust.

#### **How the public engages with global warming: a social representations approach**

*Nicholas Smith (Yale University), Helene Joffe (University College London)*

■ The present study utilises social representations theory to explore common sense conceptualisations of global warming risk. Fifty-six members of a British, London-based public were initially asked to draw or write four spontaneous 'first thoughts or feelings' about global warming. These were then explored via an open ended, exploratory interview. The analysis revealed that first thoughts, either drawn or written, often mirrored the images used by the British press to depict global warming visually. Thus in terms of media framings, it was their visual rather than their textual content that was spontaneously available for their audiences. Furthermore, an in-depth exploration of interview data revealed that global warming was structured around three themata: self/other, natural/unnatural and certainty/uncertainty, reflecting the complex and often contradictory nature of common sense thinking in relation to risk issues.

#### **Making (common) sense of the risk of new infectious diseases**

*Peter Washer (Queen Mary, University of London)*

■ In late modern societies, one important strand of risk discourse relates to the re-emergence of infectious diseases. Until the 1980s, biomedicine was convinced that future health risks would arise primarily from 'the diseases of civilisation', namely cardiovascular disease and cancer. Since the appearance of HIV/AIDS in 1981, infectious diseases have come back into focus as a topic of both scientific and socio-scientific concern. Scores of new infectious diseases have been identified over the past three decades, including SARS,

variant Creutzfeldt-Jakob disease and antibiotic resistant bacteria. This presentation will track the passage of these 'emerging and re-emerging infectious diseases' from the reified world of biomedical science and epidemiology via the media into everyday meaning systems and common sense. British newspaper coverage of the initial reactions to SARS will be compared with the reporting of the 'mad cow disease' story between 1986 and 1996, and the reporting of the 'hospital superbug' between 1995 and 2005. Media messages about 'superbugs' will also be compared with interview data gathered from a demographically diverse sample of 60 people from the Greater London area in 2007. Generally, the risks that new infectious diseases potentially pose are distanced by othering. Others are said to be at risk because they are dirty, eat disgusting food, have bizarre customs and have perverted or promiscuous sex. This pattern was seen in the representations of SARS, with Chinese habits and food described in ways meant to provoke 'our' disgust. For a British readership, the risk of 'mad cow disease' could not be distanced in the same way, so the blame for the threat was directed upwards, to government incompetence or to corrupt agricultural elites. Another strand of blame was laid on modern farming methods and 'the way we live now'. Similarly, the risk posed to the healthy self by 'superbugs' was distanced outwards onto the weak and the elderly, or the blame was directed towards incompetent hospital managers and government neglect of the National Health Service. This presentation will demonstrate how blame, traditionally directed outwards, but increasingly now directed upwards, is a key aspect in the formation of common sense notions of the risks of infectious diseases.

#### **Risk and the brain: how the media represents risks to brain health**

*Clíodhna O'Connor (University College London)*

■ The public profile of neuroscience has expanded dramatically in recent years, with the brain increasingly appearing as a point of reference in public discourse. This paper examines how social representations of this emerging science intersect with ideas of risk, drawing on a content analysis of representations of brain research in the UK print media between 2000 and 2010. 2931 articles that made reference to brain research were analysed both quantitatively and qualitatively. Analysis revealed that the most prevalent concerns within the sample were with 'optimizing' brain function (mentioned in 43% of articles), psychopathology (36%), and cognitive processes (24%). Running throughout the data was an underlying sense of 'riskiness': brain health was represented as a tenuous



state that was subject to many threats, including psychiatric disorders (e.g. dementia), potential neurotoxins (e.g. drugs), and environmental hazards (e.g. mobile phones). The most salient type of risk, however, was the relatively amorphous threat of general cognitive decline, usually linked to ageing. Much of the data revolved around prescribing measures that people could undertake to mitigate this risk of decline, usually advising strategies related to nutrition, mental exercises or physical activity. The brain was thereby represented as a resource that demanded constant attention and calculated effort on the part of the individual. The paper examines how media coverage advocated a regime of self-monitoring and self-discipline in the service of mitigating risk and 'boosting' brain function.

## W3 Climate change and natural hazards

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*Chair: Gisela Böhm (University of Bergen)*

### **Social capital in risk perception**

*Seda Kundak, Handan Turkoglu, Alper Ilki (Istanbul Technical University)*

■ The level of risk perception of a community depends on numerous indicators related to their individual features as well as the social structure of their environment. Links among social actors of a community either enhance or reduce the organizational capacity in coping with disastrous events. These links can be described as "bounding", "bridging" and "linking". Each level of interaction among actors contributes to their level of risk perception, organizational skills and way of action. Hereby, the level of interaction of Istanbul residents in the frame of construction of resilient community has been examined within 496 face-to-face interviews at the 33 different neighborhoods of the city. The primary results show that about half of the respondents have no precautions taken to reduce earthquake risks in their households as well as they have no social interactions with their community by the means of having a role in any organizations (such as NGO's) to cope with disasters. The latter links strongly to the trust level of the community to relevant organizational and governmental bodies. Furthermore, the willingness of respondents to take action in reducing earthquake risks is mostly affected by their low internal locus of

control. In one hand they believe that they are not able to cope with disasters on their own and on the other hand they think the governmental bodies do not spend enough energy to reduce earthquake risk. Overall findings show that there are weak linkages among different levels of society not only in self-organization to reduce risks but also to create resilient communities.

### **Integrating hazard and social vulnerability analysis for volcanic activity at Mount Rainier**

*Matthew White (University of Exeter), Sara Hayes (University of Plymouth)*

■ The present research combined hazard risk assessments of volcanic activity at Mount Rainier in the USA with a survey of public perceptions in three different communities surrounding the volcano. These communities were selected because the probability of different hazards (e.g. ash fall, lateral blasts, lahars, pyroclastic flows, lava flows etc.) following an eruption was different across the different locations. The aim was therefore to investigate the extent to which residents in the different areas were sensitive to these hazard differences and thus aware of the most appropriate actions to take. The survey was completed by a total of 241 residents across the three communities and contained items relating to socio-economic status, risk perception, hazard salience, beliefs about appropriate reactions, trust in risk managers and communicators and perceptions of efficacy relating to self-protective behaviours. Comparisons of formal threat assessments and public responses found evidence of both systematic over and under-estimation of risks. Residents in all three communities tended to over-estimate the likelihood of lava-flows, perhaps because these are easily imagined and often associated with volcanic eruptions. Other, more prosaic risks such as ash fall (in Ellensburg) and mud flows (in Sumner), were more likely to be under-estimated and thus not properly prepared for. Given the relationship we also found between understanding of community specific risk and emergency preparedness, the data suggest a need for more hazard specific communication in potentially affected areas, something which may also be applicable to other sites around the world.

### **Sea-level change on the Severn Estuary: creating an expert model of the risks**

*Merryn Thomas, Nick Pidgeon, Lorraine Whitmarsh, Rhoda Ballinger (Cardiff University)*

■ Anthropogenic climate change is predicted to pose a growing threat to people around the world. This is particularly salient for those living in low-lying coastal zones,

which are vulnerable to sea-level rise and changes in extreme events. As people become increasingly exposed to the risks, understanding their beliefs and responses will be ever more important. Research shows that experts and lay publics often diverge in their conception and assessment of risks. Understanding these different mental models and risk perceptions can help in developing more constructive forms of communication and participatory decision-making. Although research has identified differences in lay and expert understandings of climate change, we do not yet know how these groups understand sea-level rise and extreme events. This study uses a mental models approach to explore and compare expert and public perceptions of the risks of future sea-level change on the Severn Estuary in the southwest of the UK, with a view to the future design of risk communications. In this paper we report the first phase of the study, involving elite interviews with (n = 11) experts in the field of sea-level change on the Estuary. Each session included a semi-structured interview, the creation of an influence diagram and a subjective probability elicitation of future sea-level rise. We will discuss the results of the probability elicitation, which indicate considerable uncertainties and a wide range of possible sea-level futures. We will also outline a conceptual model of the risks, which has been developed from a thematic analysis of the semi-structured interviews and influence diagrams. This research phase underscores the complex nature of change on the Estuary, and the uncertainties involved in predicting its future response; both of which have implications for designing communications that will meet the needs of the public.

#### **A cross-national comparison of causal beliefs, risk perceptions, and policy preferences with respect to climate change**

*Gisela Böhm (University of Bergen), Ann Bostrom (University of Washington), Robert O'Connor (National Science Foundation, USA), Daniel Hanss (University of Bergen)*

■ We present a cross-national survey on climate change that investigated the role of risk perceptions and causal beliefs in the formation of policy preferences of economics and business undergraduates from six countries: Austria, Bangladesh, Finland, Germany, Norway, and USA (total N = 664). Five constructs were measured; reduced to the following dimensions via factor analysis: a) risk perception: dread, moral responsibility, equity, known risk, controllability; b) perceived causes: environmentally harmful practices, carbon emissions, volcanoes; c) perceived consequences: societal and personal consequences; d)

perceived effectiveness of policy actions: green practices, carbon policies, engineering solutions, and e) support for the same policy actions.

Differences between countries are generally small. Bangladesh is the country that differs most markedly from the other countries. For example, Bangladeshis perceive higher dread and more severe personal consequences, and identify environmental harms rather than carbon emissions as the most important cause.

Regression analyses with one of the policy support factors as criterion and the other factors as predictors show that policy support can be predicted from people's risk perceptions and causal models. In all analyses, adding perceived causes and perceived effectiveness as predictors adds significant amounts of explained variance. Perceived effectiveness is generally a stronger predictor than ascribed causes. The three models yield specific patterns of significant predictors, demonstrating that support for a specific type of policy goes together with specific risk perceptions and causal beliefs.

One implication of the results is that communicating the effectiveness of policy actions influences support for these actions more than providing causal knowledge alone. Future research may address the exact mediating roles of perceived risk, causal beliefs, and perceived policy effectiveness in shaping policy support.

## **W4 Hazards in the living environment**

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*Chair: Ric van Poll (RIVM)*

#### **Effectiveness of campaigns in raising awareness of the risk from carbon monoxide in a student population**

*David Ormandy (University of Warwick), Véronique Ezratty (EDF)*

■ Each year in the UK there are campaigns to raise awareness of risks from CO, some aimed at the public generally, others targeting groups seen as potentially vulnerable, such as students. Unlike mass media campaigns on other health related topics, there have been little, if any, assessments of the effectiveness of these CO campaigns.

The main objectives of this study were to assess – the need for campaigns (ie, knowledge of CO before any campaigns); and the effectiveness of campaigns in increasing knowledge of CO, and in influencing behavior.

This pilot study targeted students of Warwick University (Coventry, UK), living in private rented accommodation. It was designed to be impartial, adopting an approach to avoid influencing respondents. Two sets of structured interviews were carried out in controlled conditions; one at the beginning of the University year in October 2009 (Phase 1), and the second in May 2010 (Phase 2). Trained interviewers used the same format and content in both Phases. To avoid raising awareness of CO, the interviewers and participants were told that the study was about the indoor environment

Between the two Phases, campaigns and media coverage on CO, gas safety, and incidents were monitored.

The mean proportion of correct answers to CO questions in Phase 1 was 52% (N = 441), and increased significantly in Phase 2 to 72% (N = 328). There was an increase in those knowing the emergency telephone number, from 29% to 74%. However, those knowing the unsafe color of a gas flame remained low, 12% vs 13%.

Among the 92 (28%) who said they recalled CO campaigns, television was most remembered. Only 11 of these 92 said they had changed their behavior.

These findings show that the level of knowledge on CO before the campaigns was average, supporting the view that campaigns targeted at this population are needed. Although the level of knowledge to CO questions had increased in Phase 2 it had not reached a level high enough to give sufficient public health protection.

### **Communicating risks from CO: a pilot study among tenants of UK public housing**

*Véronique Ezratty (Service des Etudes Médicales d'EDF, Levallois-Perret, France), David Ormandy (WHO Collaborating Centre for Housing Standards and Health, University of Warwick, Coventry, UK), Serge Koscielny (Institut de Cancerologie Gustave Roussy, Villejuif, France)*

■ Recognizing that unintentional Carbon Monoxide (CO) poisoning is a serious public health problem, there are annual campaigns in the UK between October and April. There have been studies into the effectiveness of mass media campaigns on other health related topics, but it seems there has been little, if any, assessment of CO awareness campaigns.

Public sector tenants are considered potentially vulnerable to the risks from CO. The main objectives of this pilot study were to investigate – their knowledge of CO before campaigns, and so assess the need for campaigns; and how effective campaigns were in raising their knowledge about CO, and in influencing their behavior.

The study targeted tenants in Coventry, UK. A trained interviewer carried out two sets of structured interviews in controlled conditions, first in October 2009 (Phase 1), and again in May 2010 (Phase 2). The same format and content was used for the interviews in both Phases. To avoid raising awareness of CO, the study was designed to appear as if it was about the general indoor environment, with questions on CO mixed with those on other pollutants.

Campaigns and media coverage on CO awareness, gas safety and incidents were monitored between the two Phases.

In both Phase 1 (N = 117) and Phase 2 (N = 144), the mean proportion of correct answers to CO questions was the same, 49%. The percentage knowing the dangerous color of a gas flame was low in both Phases, 9% vs 10%. The percentage knowing the telephone number for the emergency services dropped slightly from 60% to 53%.

Of the 49 (34%) in Phase 2 who said that they recalled campaigns, television was the most remembered. Of these, 21 (43%) said that they had now changed their behavior.

Before the campaigns, the level of knowledge was average, supporting the view that campaigns targeted at this population are needed.

In Phase 2, the level of knowledge on CO had not increased meaning that the impact of campaigns on this population could be improved and better targeted.

### **Risk framing, bright-lines, and relative risk: impacts on perceptions of risk from arsenic in groundwater**

*Madeleine Baker-Goering (Duke University), Lori Benneer (Duke University), Nolan Miller (University of Illinois, Urbana-Champaign)*

■ Information disclosure programs play a vital role in informing the public about risks, yet accurate assessment of the value of information provision requires understanding how individuals respond to risk information. Previous research suggests subtle changes in information presentation can affect both risk perceptions and response to risk. This paper examines how risk perceptions are affected by variations in risk communication about environmental health risks. We conduct an experiment about the health risks posed by

arsenic in drinking water and introduce four manipulations in communication with experimental subjects: (1) the level of arsenic in drinking water, (2) framing of risk in terms of health gains or losses, (3) variations in the “bright line” for safety based on federal and state standards for arsenic in drinking water, and (4) variations in relative risk comparing respondents’ arsenic to arsenic of their neighbors. We find that participants do respond to information about the level of risk posed by their drinking water; those with higher levels of arsenic are more concerned. We do not find an effect of information framing. We find that information about “bright lines” standards and relative risk information influences perceptions for participants with intermediate levels of arsenic only. These results support a rational choice model, as these participants at high and low levels of risk were able to understand the risk they faced and additional information did not unnecessarily heighten their perceptions of risk. This suggests the existence of sensitive levels of risk where people can be influenced by additional information.

#### **Concern about the residential situation in the Netherlands**

*Ric van Poll, Oscar Breugelmans, Jeroen Devilee (RIVM)*

Concern about a hazardous living situation is an important constituting aspect of residential satisfaction. Concern may be best conceptualized as the cognitive component of general anxiety.

■ We examined concern about the actual residential situation in a representative sample of residents in the Netherlands. To be more specific, concern about 11 situations (living in or near: a busy street, below sea/river level, agricultural area, near an airport, railway track, approach route airplanes, transport route hazardous substances, overhead power lines, polluted soil, hazardous industrial facility, mobile phone antenna) was evaluated by means of a questionnaire. We also assessed residents’ concern about the health consequences of air pollution (indoor and outdoor). The face-to-face questionnaire study was conducted in the end of 2008. Well over 1200 residents in the Netherlands participated in the study. The proportion of people concerned (score of 5, 6 or 7 on an 11-point scale from 0 to 10) or severely concerned (score of 8 or higher) was assessed.

The results show that most people are concerned most about living near polluted soil (36% severely concerned), a hazardous facility (31%) and a transport route for hazardous substances (30%). Residents appeared to be least concerned about living in or near an agricultural area (7% severely concerned). In the past decade less people appear to be

concerned about their living situation, however the proportion of people severely concerned increased. Two exceptions: overall concern for ‘busy streets’ decreased (that is both concern and severe concern), for mobile phone antenna’s overall concern (concern and severe concern) increased. Concern about health was asked for the first time in this inventory. It appeared that 15% of the residents are severely concerned about possible health effects of the quality of indoor air. Nearly 20% is severely concerned about possible health of the quality of the outdoor air.

Most people appear to be concerned most about the ‘classical’ man-made hazards in the living environment (e.g.: polluted soil, hazardous facility, transport route hazardous substances), however concern about ‘new’ hazards (mobile phone antenna) is increasing. One out of 5 to 6 people is concerned about possible negative health effects of the air we breathe.

## **W5 Risk, fear and nuclear power**

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*Chair: Matthias Dhum (ETH Zurich)*

#### **Determinants of avoidant purchasing behaviors due to fear of radioactive pollution**

*Shoji Ohtomo (Konan Women’s University), Yukio Hirose (Kansai University)*

■ Avoidant purchasing of food products due to fear of radioactive pollution after the Fukushima nuclear accident was a serious social problem. This study examined consumers’ psychological processes that determined avoidant purchasing behaviors within the dual-process model (Ohtomo et al., 2011). The model hypothesized that both of intentional motivation based on rational decision and reactive motivation based on non-reflective decision predict the behaviors. Moreover, this study assumed that the attitude toward avoidant purchasing, injunctive norm (i.e. significant others’ expectation), and descriptive norm (i.e. perception about what most people were doing) in relation to avoidant purchasing are determinants of motivations.

Residents in Tokyo metropolitan area participated in Internet surveys at three times (in April, June, and November, 2011) in relation to avoidant purchasing of vegetables, fruits, fish meats, and dairy products from the Tohoku district. A total of 681 participants com-

pleted the three surveys. The avoidant purchasing behaviors continued increasing from April to November. Although both intentional and reactive motivation determined avoidant purchasing behaviors in April, only intentional motivation determined the behaviors in June. In November, both intentional and reactive motivation determined the behaviors again. Attitude was a main determinant of the motivations each time. The injunctive norm affected intentional motivation and the descriptive norm affected reactive motivation. Previous avoidant purchasing behaviors predicted the further behaviors. Our results showed that avoidant purchasing is an intended and planned behavior, rather than non-reflective and reactive behavior. Furthermore, attitude and previous behaviors were important determinants of the dual-process model. Therefore, attitude and behaviors formed in April continued to strengthen the further decision of avoidant purchasing.

#### **Risks as objects of collective fear. A case study in social psychology after Japan 2011**

*Jean-Louis Tavani (University Paris Descartes – Laboratoire Psychologie des Menaces), Andreea Ernst-Vintila (University of Reims, France)*

■ Our study provides empirical evidence for the fact that a complex event such as the Fukushima disaster of 2011 elicits a differential sociocognitive treatment based on its attributed "origin". We focused on the three environmental risks that produced the Fukushima complex disaster of 2011: the earthquake, the tsunami, and the nuclear catastrophe. Risks were analyzed as "objects of collective fear" based on a taxonomy of collective fears suggested by Rouquette (2007). This author argued that an object of collective fear and the "reason" attributed to it are two separate things, and he suggested that the "origin", or "reason", attributed to any "frightening or disturbing" event may fall in one of the four cases obtained by crossing the human vs. non-human and the intentional vs. non-unintentional origin that is attributed to it.

81 questionnaires using a standard BCS procedure for the study of social representations were given after the Fukushima disaster (2011) to French participants randomly assigned to one of the three experimental conditions: earthquake, tsunami, nuclear disaster.

The results show that a complex "object of collective fear" such as the Fukushima disaster of 2011 "mobilizes several kinds of causality, alternative or competing" (Rouquette, 2007). Indeed, a pattern of the social thinking appears to single out the earthquake as the only "natural" event, in contrast to the tsunami and the nuclear catastrophe. Also, the three risks are not consensually attributed the same "origin": while a majority of partici-

pants views the tsunami, for instance, as an unintentional natural hazard, a minority views it as having a human origin. Its meaning, then, is not the same for all, nor are the actions to control it. These different scenarios may account for the differences in the sociocognitive treatment of a complex event and probably for the change in its event status in times of crises, noted by Wolter (2009), along with increased collective mobilization.

#### **The role of emotional images in the differential perception of nuclear technologies**

*Matthias Dhum, Corinne Moser, Pius Kruetli, Michael Stauffacher, Roland W. Scholz (ETH Zurich)*

■ The perception and appraisal of risk situations is determined by two interacting processes: deliberate analytical evaluations and unconscious intuitive feelings. The extent to which either of these processes is activated depends, among others, on the availability of information on the topic and the modality of presentation. Usually, the appraisal of such situations or stimuli is assessed by means of questionnaires, items and Likert scales which presumably trigger more analytical processes, given the necessity of verbal information to describe the risk. In this study we used a wide range of emotional images from the International Affective Picture System (IAPS) as stimuli to elicit a spontaneous intuitive response on two non-verbal rating scales. Using an online survey, we presented 54 pictures in a randomized order to 201 participants from Switzerland. Results of an exploratory factor analysis supported the classification of the pictures in six distinct categories. Moreover, the subjective ratings of the emotional images proved to be suitable to demonstrate the predominant gender differences often found in the literature on risk perception. Pictures of nuclear technologies were rated differently among men and women and were appraised as negative as unpleasant pictures from other realms. A detailed analysis on a single picture level revealed the diverse perception of different aspects of nuclear technologies. Furthermore, the subjective appraisals of these pictures highly correlated with the attitude towards nuclear power and a deep geological repository for radioactive waste. In conclusion, we demonstrate the validity of emotional images as an instrument to elicit a spontaneous appraisal of a risk situation. At the same time the results provide evidence for the importance of intuitive processes in risk perception.

## W6 Precaution

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*Chair: Sweta Chakraborty (University of Oxford)*

### **The influence of precaution on the treatment of uncertainties in food risk assessment**

*Eve Feinblatt (INRA – French National Institute for Agricultural Research)*

■ The aim of this paper is to examine how the concept of precaution has shaped the ways uncertainty is treated in food risk assessments. Two crucial issues have been raised in discussions on precaution: the expression of uncertainties in the assessment of risks, as well as the involvement of stakeholders and lay people in the production of knowledge for policy making, in particular to highlight uncertainties which had not been raised before.

The paper explores how regulatory agencies have responded to information produced by other bodies, as university research laboratories, industries, or environmental and consumer rights non-governmental organisations, and how they integrated these information in their risk assessments. It addresses specifically one pivotal aspect of risk assessments: the part allocated to the treatment of uncertainties for the characterisation of the dose at which a substance could have a toxic effect. The cases of the assessments of bisphenolA and perchlorate, in the United States and in Europe, are used to illustrate this point. These two cases are characterised by different institutional backgrounds, different degrees of public controversy and different stakes involved.

Based on an analysis of the risk assessment methodologies and interviews made with the actors producing the assessments (i.e. staff from regulatory agencies, experts from Panels or working groups, peer reviewers) the paper shows that the core issue of precaution – take an action in a context of uncertainty – and the inputs from other bodies has led regulatory agencies to produce risk assessments based partly on novel approaches for the treatment of uncertainties. The paper proposes a classification of these different approaches and of the conceptual frameworks in which they are embedded. It argues that in addition to expressing uncertainties, as recommended by regulatory agencies, making explicit these frameworks could help inform better policy making.

### **Confirmatory factor analysis of a scale of social beliefs about the environmental precaution and its relationship with the new paradigm of human interdependence and risk perception**

*Juan Martinez-Torvisco (Faculty of Psychology. University of La Laguna), Ernesto Suarez (Faculty of Psychology. University of La Laguna), Luisa Lima (Instituto Universitário de Lisboa, ISCTE-IUL, Centro de Investigação e Intervenção Social (CIS), Portugal), Rui Gaspar (Instituto Universitário de Lisboa, ISCTE-IUL, Centro de Investigação e Intervenção Social (CIS), Portugal), Sara Gorjão (Instituto Universitário de Lisboa, ISCTE-IUL, Centro de Investigação e Intervenção Social (CIS), Portugal)*

■ This study was partially supported through a grant of the Spanish Ministry of Science and Innovations (PSI2009-08896 (subprogram PSIC) Psychosocial Dimensions of Sustainability: elements and behavioral effects.

The patterns of economic benefit that influence in the current level of techno-scientific development presuppose the need of an implementation the most quick and immediate as possible new tools, products and technological innovations. However, the global and irreparable dimension of potential environmental damage associated with any of these technological initiatives has indeed behaved consideration of our social context in terms of the societies of the risks. In response to this approach, since the Conference of United Nation celebrated in Stockholm in 1972, on the human environment, the precautionary principle has been emerging, in the field of international political declarations on the conservation of the environment, as one of the main bases for environmental management.

Along with other concepts such as “safety margins” or “minimum safety standards”, the attention and application of the Principle of caution presupposes the adoption of measures to advance or anticipate and to avoid serious or irreversible damages before or without previous demonstration that this action is necessary. Thus the “precautionary principle” can be defined as a procedure to incorporate the scientific uncertainty in the field of decision-making, either as a procedure for the analysis of risks or as a generic rule associated with the study of environmental impacts.



The study presented here aims to confirm the one-factor solution of a scale of measure of the beliefs associated with the precautionary principle and its relationship with environmental beliefs. For it a sample of 281 people was used, some of them university students and other Spanish workers, they fill up a pencil questionnaire which incorporates a scale of beliefs about the environmental precaution. This scale is related to the measurement of New Paradigm of Human Interdependence in its extended version. The results are discussed in terms of reliability and validity scale based in precautionary principle and its significant link with risk perception and appreciation of human interdependence. Also these data will be compared with those obtained in a Portuguese sample to analyze the validity the instruments used.

### **The varieties of precaution**

*Oliver Todt, José Luis Luján (University of the Balearic Islands)*

■ There currently exists a lack of agreement on the exact definition and application of the precautionary principle, not only on a theoretical level but also in policy making. Hence, from the analysis of academic literature, policy and regulatory documents, as well as related controversies we develop a typology of three interpretations of the precautionary principle: a) a moderate interpretation that gives existing scientific knowledge an important role in determining harm, b) an intermediate interpretation that acknowledges the need for scientific, risk-assessment-type analysis, without, however, restricting it solely to standard risk assessment, and c) a stringent interpretation in which the precautionary principle is understood as a principle for selecting technologies. We characterize these three interpretations of precaution by focusing on four analytical dimensions: 1) the nature of uncertainty, 2) the basis for regulatory decision making, 3) policy and risk management, and 4) the implications for scientific and technological innovation. The results of our analysis show that the different interpretations of precaution are the consequence of variations in the understanding of scientific uncertainty. Furthermore, there is a direct link to the question of what scientific knowledge is and what role it plays in regulation and decision making. Our typology permits a conceptual systematization of the different approaches regarding the precautionary principle in policy, philosophy and social controversy, while facilitating understanding of some of the deeper roots of science and technology policy debates.

### **Regulatory transparency: two qualitative studies of US FDA initiatives and their implications for Europe**

*Sweta Chakraborty (University of Oxford), Ragnar Löfstedt (Kings College London)*

■ Recent calls for transparency targeted towards regulatory bodies such as the US Food and Drug Administration has prompted investigation into the indubitable adoption of such measures. Specifically, the FDA's quarterly postings of AERS (Adverse Event Reporting System) signals on its CDER (Center for Drug Evaluation and Research) website, stemming from FDAAA legislation introduced in September 2007, is analysed from a risk perception and communication perspective. This presentation will discuss two qualitative studies conducted in the United States examining public perceptions and subsequent reported behaviour related to increased transparency. The results found that signals postings may prove counter productive in terms of increased public alarm and early or inappropriate termination of a drug appearing on the list. It was also found that communication from the FDA was perceived as inaccessible or confusing, particularly in that the AERS signals are posted strictly on the web. It is recommended that the FDA reconsider its communication strategy of AERS to the public as it may prove to be a 'transparency step too far,' and that European regulators take these findings into account before the implementation of any similar type transparency measures.

## **W7 Governance of crime risks**

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*Chair: Tim Prior (Center for Security Studies CSS, ETH Zurich)*

### **Risk complicity perception: the case of web-enabled telephony**

*Jerry Busby, Dan Prince (Department of Computing, Lancaster University)*

■ The perception of risk in relation to the Internet and Internet-based services has been explored in the literature for some time (for example Sjöberg and Fromm, 2001; Horst, Kuttschreute and Gutteling, 2007). We argue that because risk is a normative concept (for example Power, 2009), such that creating a risk also creates obligations, it is important to understand not just the way risk is perceived but also the way that responsibility for risk is perceived. In particular, we suggest it is important to have a concept of risk complicity



(following Busby, 2008) where there may be a principal agent for a risk, for example a fraudster or hacker, but where some responsibility is also attributed to other actors such as users, service providers and technology developers. In this study we use a questionnaire survey to investigate perceptions of complicity in risk arising with web-enabled telephony, a domain in which increasing technological capabilities makes for an increasingly attractive target for attackers (Salerno et al, 2011). The study particularly aims to explore how the distinguishing properties of the technology influence perceptions of complicity. These properties include plasticity, virtuality, ubiquity and complexity. The exploratory questionnaire design uses a series of narratives in which technology properties are systematically varied in the context of several evolving scenarios. Two groups of subjects – one a set of postgraduate students on a computer security course and the other a set of undergraduate students on a management course – were asked to rate levels of risk and levels of complicity for all relevant actors, and to give their reasons for the ratings. An analysis of the results will be available by the time of the conference.

### **Managing financial crime risk across global banking territories**

*Rachel Southworth (Cardiff University)*

■ Financial crime is an ambiguous yet global phenomenon. The regulatory requirements upon international financial services firms to prevent, detect and monitor incidents of financial crime, differ according to individual jurisdictions and their legal frameworks. This paper will explore some of the internal tensions that exist within international banking organisations in terms of defining and responding to financial crime risks across multiple, global territories. The research looks at issues relating to the practical implementation of global architectures, systems and controls in order to prevent crime and reduce 'regulatory arbitrage'. This involves harmonising group risk assessments and prioritising risk in accordance with the legal and regulatory agendas of multiple jurisdictions, as well as co-operating with regional, national and international law enforcement bodies and intelligence agencies. Strategic vision is required within banks to oversee and co-ordinate what can be referred to as the internal 'financial crime control community' – a network of departmental functions and regulatory actors that exist across geographical, organisational, hierarchical and cultural structures. The methodology for this empirical research included seven months observation at a UK based, global bank, as well as interviews with banking staff and law enforcement representatives in the UK, Singapore and Hong Kong.

The qualitative data findings highlight the need for enhanced transparency at the domestic and international level in order to improve financial crime risk communication between Banks, Regulators and Law Enforcement Agencies (LEAs). This includes a need for increased understanding of (1) the differences between organisational and intra-organisational conceptions of financial crime risk; and (2) the relationship between organisational risk-framework methodologies, knowledge transfer and risk response.

### **Risk and resilience in security governance**

*Tim Prior (Center for Security Studies (CSS) ETH Zurich)*

■ Since the 1990s, and particularly since the September 11 terrorist attacks in New York, the unpredictability and 'unknowability' of threats to security has pushed the discourse concerning security from terrorism to terror – in general, mainstreaming fear by highlighting that threat is "everywhere and nowhere". This has complicated the governance of security, which is increasingly devolved to diffuse networks of non-governmental actors or agencies. In addition, systemic planning for preparedness, rather than prevention, has highlighted the need for a precautionary approach to governing risks and their implications for society.

Within this changing security climate, the incorporation of resilience into security policy and decision making has become a dominant maxim, but one that has often occurred in an ad hoc manner. It has become the "pervasive idiom of global governance". The ambiguous nature of the concept, and its non-systematic incorporation into the management of public and private sector risk and security, raises issues concerning the effectiveness, longevity, meaningfulness and operationalisation of policy and practice based on resilience approaches. If indeed resilience is as important a component of security as has been reflected in recent public policy and private industry documentation and debate, then a contextual reflection on, and seamless and systematic integration of this concept in security decision making and governance is imperative.

This project takes a transdisciplinary approach to explore resilience in security governance, and investigate how decision makers can systematically incorporate resilience into security-related policy and practice. It will utilise a mixed methodology to develop theoretical and empirical understandings of resilience in security to inform tools or frameworks that ensure the appropriate application of resilience in security governance.

## W8 Residential areas and risk

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*Chair: Sophie Gaultier-Gaillard (Université Paris 1 Panthéon Sorbonne)*

### **Crossover effects between noise annoyance and environmental risk perceptions. The intermediating role of the meaning of sounds**

*Jeroen Devilee, Irene Van Kamp (RIVM)*

■ Although noise annoyance and environmental risk perceptions are both effects of environmental stimuli, these study objects do not meet each other very frequently. However, a current trend in the study of noise and sound is to extend the scope from annoyance by decibels to the study of auditory environments. In the study of these environments one focuses on wanted and unwanted sounds that are not necessarily very loud. As a result the meanings of sounds are of a growing importance. Bijsterveld (2008) made a classification of sound fragments as these were stored in the archives of the World Soundscape Project (Schafer, 1977). She concluded that sounds have two negative and two positive evaluations. When sounds are evaluated negative these can be intrusive or sinister. Positively evaluated sounds can be sensational or comforting. Up until now the bulk of the attention in the study of noise and sound has implicitly been given to sounds that were perceived as intruding. However, the acknowledgment of other meanings of sounds paves the way for other approaches.

The relevance of the meanings of sounds is illustrated by a study that examines the driving factors behind noise annoyance by mopeds and mopas. National surveys in the Netherlands show that these vehicles are considered to be the most annoying type of road transport. This fact cannot be explained by the noise levels that only have a very tiny contribution to the noise by road traffic. A relevant aspect of mopeds and mopas is that the meaning of the sound of these machines can be completely different for the youngsters that use them (sportivity, kick against society, freedom) and the receivers of these sounds (unnecessary, stupidity).

We tested our assumptions about the influence of negative meanings on the annoyance by mopeds and mopas by including items that expressed concern about health and

safety in a regression analysis. Significant effects were found for several of these items. Other relevant explanations for the annoyance by moped and mopas are that these vehicles produce sound events that can easily disturb auditory environments and that the number of these vehicles is growing. Based on the findings in the study it was possible to formulate policy recommendations to extend the current sound level repressive approach with local measures to improve sound quality.

### **Is it worth creating green corridors in cities?**

*Sophie Gaultier-Gaillard, Florent Pratlong (Université Paris 1 Panthéon Sorbonne)*

■ Nowadays green corridors are quite well developed in our urban cities, in order to contribute to create more biodiversity, in terms of urbanism, ecology, environment and even sociology. Those green corridors are daily used for free by the local residents but this does not mean that those natural goods have no economic value. To justify or not the creation of those green corridors, we need to better evaluate their market value, because they represent a huge cost for the public authorities to be maintained and developed. We have used contingent valuation, after having questioned 534 individuals, in the east suburb of Paris, in three different sites. We have collected three different types of information: firstly, the use of those green corridors, and the frequency of use, secondly, the degree of environmental consciousness-raising of the individuals and thirdly, the socio-economic data to better understand their motivations. We have proposed different scenarios and three types of payments: a paying entry (kind of toll) to be able to enter the site, a fixed annual price for the potential users and an extra tax. The econometric model found is quite good, due to the Fisher-statistic. We have put into light different valuations corresponding to each site, according to the way the individuals use it and the characteristics of each of those sites. We have determined the average annual cost tolerated by those individuals, according to the type of payment: 0,36 euros for a toll, 6,45 euros for a fixed annual price, and 18,10 euros for an extra tax. This is still a mean and needs to be interpreted for each situation according to the characteristics revealed by the questionnaires and the individual characteristics of the sample.

# POSTER ABSTRACTS

## **Nanoremediation: are there equity concerns?**

*Mary Collins (University of California, Santa Barbara), Barbara Harthorn (University of California, Santa Barbara), Terre Satterfield (University of British Columbia)*

■ Nanoremediation, or the use of engineered nanomaterials in the cleanup of contaminated waste sites, is a technological advancement that has the potential to reduce cleanup costs while increasing overall quality. Although this technology is being widely used, the environmental and human health risks are poorly understood and debates between those subscribing to the precautionary principle versus proponents of rapid dissemination continue. In light of this uncertainty, populations living close to sites could be viewed as

subject to either potentially adverse risk exposures or as lucky beneficiaries of modern cleanup technology. Using multiple data sources, this exploratory study addresses whether any socio-demographically defined subpopulations (high minority and low socioeconomic status percentages) are disproportionately represented in the communities surrounding nanoremediation sites. Preliminary results indicate a general balance in the distribution of risks and benefits. It nevertheless raises questions about the role of communities in local environmental decision making and the risks that they face under conditions of technological uncertainty and the evolution of application-specific technological risk perception in society.

### **A content analysis of traditional media and social media activity during the 2008 Irish dioxin food crisis**

*Aine McConnon, Liran Shan, Aine Regan, Patrick Wall (University College Dublin)*

■ In a food crisis, the media can perform an agenda building role by interpreting risk information. According to agenda-setting theory (McCombs & Shaw, 1972), the media can successfully influence level of public attention given to issues based on the coverage they decide to attribute to certain issues. Second level agenda setting proposes that the media can frame coverage in such a way so as to draw public attention to certain attributes of an issue. Second level agenda setting could be enacted in a food crisis context when media choose particular elements of the crisis to report on, including the types of information sources they choose to reference, and how they decide to package the story. The current study performed a content analysis of traditional and social media content during the 2008 Irish pork dioxin crisis in order to examine what content consumers were exposed to and whether this content differed by media type. In particular, this study was interested in investigating information source, message tone, and topical focus. 141 newspaper articles and 175 social media postings from blogs, forums, and Twitter, were retrieved via information aggregators and content analysed. Media have the ability to choose which information can go forward to the public domain, and which information can be kept silent; a second-level agenda setting concept referred to as 'Gatekeeping'. The current study identified key information sources most frequently cited and given a platform. Findings showed that certain features of the crisis were more likely to be reported depending on the media format. Social media concentrated on a few key topics whilst traditional media were much broader in their reporting of topics, implying that traditional media is more likely to offer a thorough view of a food crisis event compared to social media. Implications of different media communications for risk communication will be discussed.

### **The Netherlands Safety and Security strategy and the National Risk Assessment**

*Marcel G. Mennen (National Institute of Public Health and Environment)*

■ Threats to our safety and security are continuously changing and are becoming increasingly interconnected. In order to classify potential risks, threats and hazards and enhance adequate preparation and capacity building, the Dutch government approved a National Safety and Security Strategy based on a multi-criteria analysis approach. The Strategy comprises an All Hazard policy, which implies that both natural hazards, hazards

caused by technical failure and malicious threats are included. The hazards analyzed vary from floods, flu pandemics and nuclear incidents to large-scale riots or terrorist attacks. Analysis of potential threats and hazards is performed using a methodology called the National Risk Assessment. In this methodology threats and hazards are described in scenarios, which are assessed in terms of likelihood and impact using a uniform scoring method. The impact criteria reflect the five vital interests: territorial security, physical safety (public health), economic security, ecological security and social and political stability. The results of the assessment are presented in the risk diagram, in which the likelihood and impact of each scenario are plotted, so that they can be uniformly compared. The National Risk Assessment is produced by an expert network consisting of a large number of research institutes, universities, civil services, public service corporations and consultancy firms. Together, these organisations have got the knowledge, expertise, skills, models and instrumentation covering all aspects related to national safety and security risks. In this way, a multidisciplinary and scientifically sound approach is guaranteed. Policy and decision makers use the scenarios and the risk diagram to determine measures and priorities necessary to improve capacity building enhancing preparation to hazards and threats.

### **Contrast or assimilation? Effects of the Tohoku earthquake and crisis at Fukushima nuclear plant on public anxiety regarding number of hazards**

*Kazuya Nakayachi (Doshisha University)*

■ This study investigates the changes in public anxiety regarding a variety of hazards after the 2011 Tohoku earthquake and the resulting crisis at Fukushima. The Tohoku earthquake resulted in more than 19,000 casualties, including deaths and missing persons. More than 300,000 people have still not returned home. It is therefore not surprising that the Japanese people are increasingly anxious about earthquakes and mishaps at nuclear power plants. This research focuses on other types of hazards (e.g., asbestos, traffic accidents, fires, typhoons, etc.) and examines whether public anxiety with regard to them has decreased by the contrast effect or increased by the assimilation effect. In January 2008 and January 2012, two surveys were conducted that measured the participants' anxiety toward 51 kinds of hazards. In the 2008 survey, 2,200 adults were selected from the basic registers of residents in Japan using a stratified two-step random sampling method. 1,922 of them (54.2%) rated their anxiety using six-point Likert scales. The 2012 survey, post the

Tohoku earthquake, was conducted in the same manner. The results of the 2008 survey revealed that the highest-anxiety hazard out of the 51 items was “Earthquake,” even though the survey was conducted before the Tohoku earthquake. The mean rating of “Accident at a nuclear plant” was nineteenth in the list of 51 items. An exploratory factor analysis extracted seven factors and showed that “Earthquake” was loaded highly on the “Crises of environment” factor and “Accident at a nuclear plant” was loaded highly on a “Topical event.” It is hypothesized that the hazards highly loaded on the same factors will be assimilated to the earthquake and accident at the nuclear plant, and that the anxiety regarding them will increase. On the other hand, anxiety regarding the hazards that are not relevant to these factors will decrease by the contrast effect. The results are reported in this presentation.

### **Risk- and responsibility-sharing in flood risk management**

*Thomas Thaler (Middlesex University)*

■ New policy paradigm and strategies included new discussion and changes about relationship and responsibility between different agents. The current focus of policy discussion refers two main aspects (a) fair sharing of risk-burdens between public authorities and non-state actors and (b) sharing responsibility.

Risk- and responsibility-sharing comprises new governance practices, which include new regulations, organisations and institutions. Main problems can be (1) only a (re-)imagination process of fair sharing of risk burdens, (2) shadow of more democratic processes, (3) shadow of hierarchy and balance of power between the different stakeholder groups as well as (4) ‘hollowing out’ the state.

The poster deal with the following questions: what is responsibility? How do we frame risk- and responsibility-sharing in flood risk management? Does this circumscribe solve the problem?

### **Environmental friendly purchase behavior in the context of climate change risks – testing the low-high cost hypothesis**

*Aysel Tikir (Zurich University of Applied Sciences)*

■ Since 1991 the low-high cost hypothesis developed by Diekmann and Preisendörfer criticizing the Rational Choice Theory (RCT) there were several studies attempting to test the RCT under different conditions (e.g. Diekmann and Preisendörfer 2003, Brüderl 2004, Best 2007, 2009, Bamberg et al. 2008). Diekmann and Preisendörfer (1991, 1992) stated that people behave environmental friendly in low cost situations rather than in high cost situations and that this relationship is stronger than the effect of the environmental friendliness scale. To test whether Rational Choice theory is valid under low-high cost situations an online survey was conducted in 2010/2011 focusing on purchase behavior of beef and fruits and vegetables (Swiss production, import product, organic and conventional production).

Following Best (2007) the importance of different purchase criteria (price, quality, transport distance, environmental friendly and livestock friendly production) were measured and linked with the purchase behavior itself. By assessing the price for every single purchase alternative by themselves, the respondents could define a purchase alternative as low or high cost situation. With respect to Diekmann and Preisendörfer (2003) the environmental friendliness scale and in addition descriptive measures such as gender, age, education and income were measured too. With a sample size of  $n = 2405$  the response rate was 9.25%.

First results show that respondents see a big difference between Swiss versus import products and between organic and conventional production. In multiple group comparisons using the structural equation modeling there is a bigger effect of the environmental friendliness scale than the price of the product in high cost situations such as the purchase of organic products, whereas climate change risks show rather small effects. Therefore the results do not confirm the low-high cost hypothesis. Theoretical implications are made.

# Author index

---

Aarset, Magne .....	12, 29	Bostrom, Ann .....	12, 18, 31, 32, 91	Cugat, Gloria .....	13, 41	Ezratty, Véronique .....	18, 91, 92
Adams, John .....	12, 20, 24	Bouder, Frederic .....	17, 76, 77	David, Jean-François .....	16, 75	Farré, Jordi .....	15, 16, 63, 71
Allard, François .....	13, 46	Breugelmans, Oscar .....	18, 93	Dawson, Ian .....	14, 58, 59	Fast, Margaret .....	14, 52
Alriksson, Stina .....	16, 74	Brinkmann, Johannes .....	12, 29	De Bruin, Marijn .....	17, 80	Feinblatt, Eve .....	19, 95
Alstrup-Jensen, Keld .....	12, 36	Bründl, Michael .....	15, 60	De Vocht, Melanie .....	13, 40	Filipsson, Monika .....	16, 74
Altarejos-García, Luis .....	14, 56	Bryant, Karl .....	12, 31	Demski, Christina .....	17, 77, 79	Fiordelli, Maddalena .....	16, 73
Althaus, Chris .....	13, 39	Bubela, Tania .....	14, 51	Devilee, Jeroen .....	18, 19, 93, 98	Fischer, Arnout .....	13, 42
Ammerlaan, Karin .....	14, 54	Busby, Jerry .....	19, 96	Dhum, Matthias .....	19, 93, 94	Fisher, Len .....	14, 55
Aoyagi, Midori .....	17, 78	Butler, Catherine .....	16, 70	Dias de Avila Pires, Fernando .....	13, 39	Florin, Marie-Valentine .....	14, 55
Arvai, Joseph .....	12, 14, 37, 38, 53	Carley, Sanya .....	25	Dijkman, Anja .....	13, 43	Foss Hansen, Steffen .....	12, 35, 36
Atun, Funda .....	17, 82	Carvalho, João .....	14, 49	Dijkstra, Anne .....	13, 43	Frey, Dieter .....	12, 28
Baker-Goering, Madeleine .....	4, 18, 92	Castillo-Rodríguez, Jesica .....	4, 14, 56	Diviani, Nicola .....	16, 73	Friedman, Sharon .....	13, 42, 43
Ballinger, Rhoda .....	18, 90	Caubergh, Verolien .....	13, 40	Dohle, Simone .....	14, 15, 53, 65	Frisch, Anne-Linda .....	16, 17, 73, 81
Barnett, Julie .....	5, 12, 13, 14, 33, 34, .....40, 41, 44, 49, 50	Chakraborty, Sweta .....	19, 95, 96	Driedger, S. Michelle .....	14, 52	Fuchs, Gerhard .....	17, 84, 85
Baun, Anders .....	12, 36	Charpak, Yves .....	14, 52	Drottz-Sjöberg, Britt-Marie .....	14, 51, 52	Gabrielsen, Gorm .....	17, 80
Bearth, Angela .....	12, 29	Chiacchia, Raffaele .....	16, 69	Dubowicz, Arthur .....	17, 81	Gaspar, Rui .....	13, 14, 19, 41, 49, 95
Bennear, Lori .....	18, 92	Chiffi, Daniele .....	13, 46	Durbach, Ian .....	12, 37, 38	Gaultier-Gaillard, Sophie .....	5, 17, 19, 83, 98
Berchialla, Paola .....	13, 46	Claassen, Liesbeth .....	12, 13, 29, 30, 31, 39	Ebner, Franz .....	15, 65	Ge, Zhen .....	13, 42
Betsch, Cornelia .....	15, 65	Collins, Mary .....	99	Egolf, Brenda .....	13, 43	Gheysens, Jonathan .....	14, 58
Blumer, Yann B. .....	15, 62	Colombo, Simone .....	16, 74	Eiser, Richard .....	14, 59	Giannopoulos, Georgios .....	14, 57
Bodsberg, Lars .....	5, 16, 74, 75	Connor, Melanie .....	17, 82	Enander, Ann .....	5, 13, 15, 33, 44, 45, 67	Gorjão, Sara .....	19, 95
Boerner, Franziska .....	14, 52	Constantin, Marian .....	45	Epp, Astrid .....	15, 63, 64	Gosalbez, Patricia .....	13, 41
Böhm, Gisela .....	18, 90, 91	Contalbrigo, Laura .....	17, 79	Ernst-Vintila, Andreea .....	12, 19, 28, 94	Grabner, Roland H. .....	15, 65
Bohn Bertoldo, Raquel .....	13, 44	Corner, Adam .....	12, 32	Escuder-Bueno, Ignacio .....	14, 56	Graham, John D. .....	15, 20, 25
Borjesson, Marcus .....	15, 67	Cousin, Marie-Eve .....	12, 28, 29	Escurriol, Veronica .....	13, 41	Greenberg, Michael .....	18, 20, 26
Boso, Alex .....	12, 13, 34, 44, 45	Cribbin, Timothy .....	13, 41	Espluga-Trenc, Josep .....	12, 13, 33, 34, 44	Gregori, Dario .....	13, 46
		Crovato, Stefania .....	15, 17, 63, 79	Evanno, Sébastien .....	16, 70	Greninger, Peter .....	16, 68

Grêt-Regamey, Adrienne .....	15, 20, 21, 25	Karjalainen, Timo P. ....	12, 37	Lu, Yonglong.....	15, 61	Neumann, Katja.....	18, 87
Grisotti, Marcia.....	13, 39	Keelan, Jennifer .....	14, 52	Luján, José Luis .....	19, 96	O'Connor, Cliodhna .....	18, 88, 89
Groso, Amelo .....	12, 36	Keller, Carmen.....	13, 15, 47, 48, 64, 65	Luke, Michelle.....	14, 59	O'Connor, Robert .....	18, 91
Grøtan, Tor Olav .....	15, 66	Klusmann, Verena .....	18, 86, 87	Mack, Birgit.....	17, 84, 85	O'Mahony, Cian.....	13, 46
Gutteling, Jan .....	17, 83	Knol, Anne.....	12, 29	Maesele, Pieter .....	16, 69	Ohtomo, Shoji.....	19, 93
Haase, Niels.....	15, 65	Köllner-Heck, Pamela .....	15, 60	Manca, Davide.....	16, 74	Oltra, Christian .....	13, 44, 45
Håbrekke, Solfrid.....	16, 75	Konrad, Wilfried .....	12, 13, 33, 34, 35, 44	Mantwill, Sarah.....	16, 17, 73, 82	Ormandy, David .....	18, 91, 92
Hanss, Daniel.....	18, 91	Koschutnig, Karl .....	15, 65	Marcu, Afrodita.....	12, 13, 14, 34, 44, 45, 49, 50	Orquin, Jacob L.....	13, 48
Harthorn, Barbara .....	99	Koscielny, Serge .....	18, 92	Martinez-Torvisco, Juan .....	19, 95	Orru, Kati.....	14, 55
Hartman, Devin .....	25	Kosugi, Motoko.....	17, 77	Marttunen, Mika .....	37	Orwat, Carsten .....	17, 84, 85
Hauge, Stein.....	16, 75	Kraaij-Dirkzwager, Marleen .....	16, 71	Marvulli, Lorenzo.....	12, 13, 33, 34, 44	Ozdemir Yilmaz, Ozlem .....	14, 58
Haxhiaj, Arber .....	13, 46	Kråkenes, Tony.....	16, 75	Mascarello, Giulia .....	15, 17, 63, 79	Parkhill, Karen .....	12, 16, 32, 70
Hayes, Sara .....	18, 90	Krausmann, Elisabeth.....	14, 56, 57	Mays, Claire .....	13, 44	Pepermans, Yves .....	16, 69
He, Guizhen.....	15, 61	Kröger, Wolfgang.....	18, 21, 26	McConnon, Aine .....	100	Perales-Momparler, Sara.....	14, 56
Hede, Susanne .....	13, 44, 45	Kruetli, Pius.....	19, 94	Mennen, Marcel G. ....	100	Perch-Nielsen, Sabine.....	15, 60
Helsloot, Ira .....	17, 76	Kundak, Seda .....	18, 90	Merkelsen, Henrik.....	17, 80	Petrucchio, Corrado.....	15, 63
Hermans, Marijke .....	12, 30	Kuttschreuter, Margöt.....	5, 13, 15, 39, 40, 63	Merz, Bruno .....	15, 60	Pidgeon, Nick.....	12, 16, 17, 18, 31, 32, 70, 79, 88, 90
Herr Harthorn, Barbara .....	12, 31, 32	L'Orange Seigo, Selma .....	14, 53	Messer, Natalie .....	25	Pitts, Anton .....	12, 32
Hess, Rebecca .....	13, 47, 48	Labib, Ashraf .....	12, 36	Meyer, Thierry.....	12, 36	Pluess, David.....	12, 36
Hilverda, Femke.....	15, 63	Lane, Bradley W. ....	25	Miller, Nolan.....	18, 92	Poganietz, Witold-Roger .....	17, 84
Hinderer, Nele .....	17, 85	Lebret, Erik .....	12, 16, 29, 71	Milligan, Michael.....	13, 39	Poortinga, Wouter .....	17, 79
Hirose, Yukio .....	19, 93	Lechelt, Lea .....	14, 51	Mol, Arthur P. J. ....	15, 61	Poortvliet, Marijn.....	17, 79, 80
Hohmann, Roland .....	15, 60	Lee, Roh Pin.....	17, 78	Moreno Londono, Ana Maria .....	16, 17, 72, 81	Porsius, Jarry .....	13, 39
Holenstein, Matthias .....	14, 16, 54, 70	Lerner, Eva .....	12, 28	Moser, Corinne.....	15, 19, 62, 94	Poumadère, Marc .....	12, 13, 33, 34, 35, 44
Holthausen, Niels .....	15, 60	Lienert, Judit.....	12, 37, 38	Mueller Loose, Simone.....	13, 48	Prades López, Ana.....	12, 13, 33, 34, 35, 44, 45
Horlick-Jones, Tom .....	12, 13, 33, 34, 35, 44	Lima, Luisa .....	14, 19, 49, 95	Mulder, Bob .....	17, 80	Prades, Jordi .....	15, 63
Ilki, Alper .....	18, 90	Locher, Peter.....	15, 60	Murphy, Ryan O. ....	13, 48	Pratlong, Florent .....	17, 19, 82, 83, 98
Ishizaka, Alessio.....	12, 36	Löfstedt, Ragnar .....	16, 19, 69, 96	Nakayachi, Kazuya.....	100	Prince, Dan .....	19, 96
Jardine, Cindy .....	14, 51, 52	Loots, Ilse.....	16, 69	Nazir, Salman.....	16, 74	Prior, Tim .....	19, 96, 97
Joffe, Helene .....	18, 88, 89	Lores, Monica.....	16, 71	Neukirch, Mario .....	17, 85	Probst, Thomas.....	15, 60
Johnson, Johnnie.....	14, 59	Lozano, Natalia .....	16, 71				



Pütz, Marco .....	15, 60	Satterfield, Terre .....	12, 31, 32, 99	Streicher, Bernhard .....	12, 28	Van Kamp, Irene .....	19, 98
Ravarotto, Licia .....	15, 17, 63, 79	Schmälzle, Ralf .....	15, 65	Suarez, Ernesto .....	19, 95	van Poll, Ric .....	18, 91, 93
Regan, Aine .....	13, 14, 41, 50, 100	Schneider, Nina .....	13, 44	Sun, Guodong .....	13, 42	van Tol, Jan .....	17, 76
Reinders, Machiel .....	17, 80	Scholz, Roland W. ....	15, 19, 60, 62, 94	Taebi, Behnam .....	15, 61	van Veggel, Rob .....	13, 42
Reishofer, Gernot .....	15, 65	Schulte-Mecklenbeck, Michael .....	13, 48	Tavani, Jean-Louis .....	19, 94	van Woerkum, Cees .....	13, 43
Renkewitz, Frank .....	15, 65	Schulz, Peter J. ....	16, 17, 73, 81, 82	Terpstra, Teun .....	17, 83	Vaughan, Naomi .....	12, 32
Renn, Ortwin .....	16, 68, 84	Schumann, Diana .....	14, 53	Terwoert, Jeroen .....	13, 43	Verbeke, Wim .....	14, 51
Renner, Britta .....	15, 18, 65, 66, 87	Schupp, Harald .....	15, 65	Thaler, Thomas .....	101	Visschers, Vivianne H. M. ....	13, 18, 47, 86, 87
Revuelta, Gema .....	13, 41	Schweizer, Pia-Johanna .....	17, 84, 86	Thomas, Merryn .....	18, 90	Volkanovski, Andrija .....	12, 35
Reyna, Valerie .....	12, 21, 24	Seibt, Beate .....	14, 49	Tikir, Aysel .....	101	Voordouw, Jantine .....	13, 42
Ronteltap, Amber .....	13, 17, 42, 80	Seidl, Roman .....	15, 61, 62	Timmermans, Daniëlle .....	12, 13, 30, 31, 39	Wærø, Irene .....	15, 67
Rosenhead, Jonathan .....	12, 35	Serrano-Lombillo, Armando .....	14, 56	Tinmannsvik, Ranveig K. ....	15, 67	Wall, Patrick .....	14, 50, 100
Rosness, Ragnar .....	15, 66, 67	Shan, Liran .....	100	Tiozzo, Barbara .....	15, 17, 63, 79	Wallquist, Lasse .....	14, 16, 54, 70
Rossetto, Tiziana .....	18, 88	Siegrist, Michael .....	12, 13, 14, 15, 16, 18, 29, 47, 48, 53, 63, 65, 72, 87	Todt, Oliver .....	19, 96	Washer, Peter .....	18, 88, 89
Rothstein, Henry .....	17, 76	Smid, Tjabe .....	12, 13, 30, 39	Torenvlied, René .....	12, 29	White, Matthew .....	18, 90
Rowley, Jack .....	13, 39	Smith, Nicholas .....	18, 89	Turkoglu, Handan .....	18, 90	Whitmarsh, Lorraine .....	18, 90
Rudolf, Michael .....	18, 86, 87	Southworth, Rachel .....	4, 19, 97	Uyttendaele, Mieke .....	13, 40	Wiesbusch, Dagmar .....	13, 39
Rutsaert, Pieter .....	14, 51	Spruijt, Pita .....	12, 29	van Asselt, Marjolein .....	14, 54	Winton, Laura .....	14, 52
Sachs, Rainer .....	12, 28	Stauffacher, Michael .....	15, 19, 60, 62, 94	van de Poel, Ibo .....	14, 54, 56	Woudenberg, Fred .....	13, 39
Salvi, Olivier .....	16, 69, 70	Stijnen, Daniella .....	13, 42	Van der Most, Herman .....	17, 83	Yilmaz, Cengiz .....	14, 58
Sapountzaki, Kalliopi .....	14, 56	Størkersen, Kristine .....	14, 57	van Dongen, Diana .....	12, 30	Zhang, Lei .....	15, 61
Sas, Benedikt .....	13, 40			van Eeten, Michel .....	17, 76, 77	Zingg, Alexandra .....	16, 71, 72



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